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A Central-Station Company's Electric Kitchen

Fisk Street Kitchen of Commonwealth Edison Company Embodies Latest Equipment for Doing Things Electrically

By ARTHUR F. ALLSOP

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THE Commonwealth Edison Company's Fisk Street station was one of the first installations of electric cooking apparatus on a regular scale by a central station in the country. As far back as 1906 the kitchen was equipped with apparatus for cooking electrically for the men employed at the station. The equipment originally installed did yeoman service for many years, during which it amply demonstrated not only its own fitness for the work, but also that cooking electrically is the method par excellence when it comes to reducing labor and time, effecting predeterminable and uniform results, utilizing a minimum of space, and for keeping the kitchen quarters pleasant and clean. In fact, it proved that it is the ideal form of energy to employ for making heat.

Since the first installation was made, Fisk Street has developed rapidly. Turbogenerators of 5000 kilowatts, the largest installed at the time, have given place to units of 30,000 kilowatts in operation and 35,000 kilowatts on order, and when existing orders

Fig. 1.—A Kitchen That Suggests Cleanliness, Economy and Efficiency. The Allsop Steam Table Is Shown in Foreground, the G. E. Range and Control Panel in the Background.

Fig. 2.—Another View of the Electric Kitchen, Showing Hughes Bake Oven in Foreground, With G. E. Broiler and Simplex Disk Stoves in Background.

are completed Fisk Street will contain 14 units. The growth of machines and capacity has also necessitated an increase in the number of men directly and indirectly working around the plant, to which must be added the men at Quarry Street, across the river, many of whom use Fisk Street as their headquarters. It is to feed the men employed at Fisk and Quarry Street stations that the Fisk Street kitchen came into being, and it was to care for the increasing force to be fed that extensions have had to be recently made to the Fisk Street kitchen. Today, on an average, 200 and often 400 men obtain meals during the noon hour at Fisk Street, necessitating cooking some 600 pies, 2200 loaves of bread and nearly 400 pounds of meat per month.

Rush-Hour Service.

The service of the Fisk Street kitchen is a typical restaurant service, with the difference that the peak is higher even than the usual restaurant, and after the peak has passed the output of the kitchen almost ceases except for preparation for the next meal. The service is therefore really more suggestive of club kitchens and cafeterias which are open only during certain hours of noon and evening. Meals are served between 7:45 and 8:30, 11:45 to 1:00 at noon, and again in the evening between 5:30 and 6:30. The noon-day meal is the chief one, however, there being comparatively few persons to be supplied in the morning and evening. The midday meal is also the most complete, there being three courses—soup, the choice of two different sorts of meat, and dessert. In the morning porridge, ham and eggs or steak, coffee and toast are served, and in the evening one form of meat, usually steak, and dessert, coffee and bread is served. The number of persons supplied on any day depends upon conditions in the plant. There is the usual attendance, those employes of the company and contractors who always obtain their lunch at the station. Then there is the transient patronage—contractors' men—that may vary between only a few to almost 100; men from other departments working or visiting the station. The demand upon the kitchen is therefore an extremely variable one, although at least one day's notice is usually obtainable before a severe peak occurs. Three dining rooms are maintained; one is used only occasionally by various committees and officials of the company on inspection tours. Another is used by department heads and the staff, while the third is used by the workers who because of their work are unable to change their overalls while they eat.

The kitchen employs one chef, in charge of the kitchen, and several girls. The work of preparing the noon meal commences about 9:00 in the morning, and from that time on till about 11:30 the electrical cooking devices are busily employed.

Use and Cost of Equipment.

The present equipment of the kitchen, which is all that is required for the service rendered, is as follows:

Apparatus.	Make.	Capacity in watts.	App'x. cost.
1 Range	G. E.	17,000	$550
1 Bake oven	Hughes	3,500	265
1 Broiler	G. E.	5,000	125
1 Toaster	G. E.	3,150	38
1 Steam table	Allsop	2,500	325
3 20-in. disk stoves	Simplex	2,700 each	354
2 Coffee urns	Simplex	2,000 each	180
1 18x24-in. Griddle	Simplex	3,000	40

The approximate cost of the electrical cooking apparatus amounted to about $1877, while the total connected load is 46.85 kilowatts, which, however, rarely is in use all at the same time. The cost of equipment upon a kilowatt basis approximates $40 per kilowatt of capacity.

In addition to the above heating devices there is an electrically driven refrigerating machine, driven by a 5-horsepower motor.

The range is the G. E. hotel model, having two 18 by 26½-inch roasting ovens and eight 9 by 12-inch hotplates. The roasting ovens employ two lower heating units, giving two heats and consuming 1000 and 2000 watts respectively, and two upper heating elements giving two heats and consuming 500 to 1000 watts, respectively. The four front hotplates are each equipped with one heating element, each consuming 1000 watts, and the four rear plates with one heating element each consuming 800 watts. The front hotplates are for rapid heating and high temperatures, the rear hotplates are for keeping materials on the boil and warm. All heating elements are of sheathed wire, which may be easily removed for cleaning. Each element is protected by a fuse and knife switch, which are mounted upon a switchboard, shown in Figs. 1 and 2. All switches carry name plates to indicate which elements are in circuit, and the whole is protected by a two-pole circuit breaker.

The Hughes bake oven is of the No. 150 2-D type, consists of 2 compartments, and is capable of baking about 90 pounds of bread at one time. The oven is

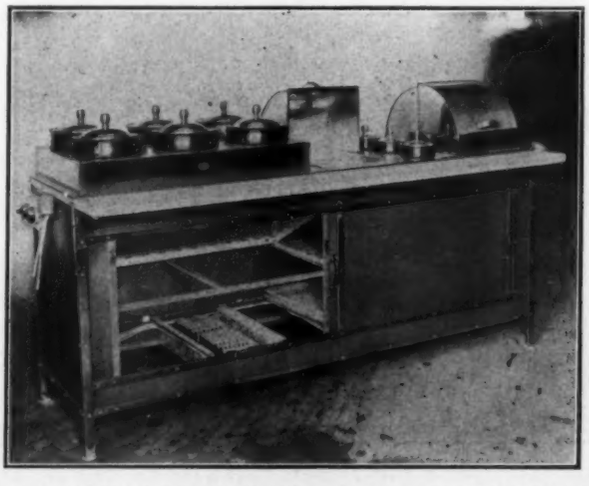


Fig. 3.—View Showing Allsop Steam Table. Two of the Heating Elements in Lower Section of Table Can Be Seen.

equipped with three heating elements, each of 1165 watts capacity, and each capable of giving three different heats. By various combinations nine different rates of energy consumption are possible. The maximum energy consumption is 3500 watts.

The steam table, which is shown in the general view of the kitchen illustrated in Fig. 1, was developed specially for its purpose by the writer, and it was built by H. Schmidt, 451 South Clark Street, Chicago. This table contains two entirely separate sets of heating units, one set in the upper section and one set in the lower section. The lower units consist of four 600-watt G. E. heating elements, the upper units being five Simplex immersion coils, each of 500 watts. Each heating unit is controlled by a three-heat switch. The table is able to steam two roast pans, three gravy pots and six 2-gallon vegetable pots. The table is constructed of planished steel with nickel trimmings; the roast pans are of solid tin, the gravy and vegetable pots of porcelain and iron, and the shelves of the lower portion of galvanized iron and the top of copper.

The broiler, known as the G. E. D-78 hotel broiler, has an effective broiling area of 368 square inches, the plate being 16 by 23 inches. At full load it is possible to broil about 36 steaks hourly, each steak weighing 2 pounds and being of about 1 inch in thickness. The top chamber is provided with specially heavy insulation, about 2 inches in thickness, to prevent radiation of heat upwards. The unit is heated by one heating element that may be operated in its entirety or in half, the wattage consumed being 5000 and 2500 watts, respectively.

The toaster is the standard G. E. hotel toaster, capable of toasting six, three and two slices of bread at one time. There are seven heating elements, controlled by two controlling switches, by the manipulation of which either three, four or all seven heating elements may be connected in circuit. The load, according to the number of heating elements connected in circuit is 1350, 1800 and 3100 watts, respectively.

The Fisk Street kitchen measures about 19 by 20 feet, which is a small kitchen when the number of persons at work and the output of edibles daily is taken into consideration. The use of electricity for cooking reduces at once the amount of space, labor and time required. The refrigerating machine also reduces the amount of work and traffic in and out of the kitchen quarters. Electrically driven fans and exhaust apparatus maintain the kitchen at pleasant temperature and free from odors at all times. The kitchen is completely electrical throughout. The Commonwealth Edison Company has another interesting electrical cooking installation in the Edison Building, although a very much smaller one than that described. This latter is used for cooking meals for various committees and for social and club meetings and similar special occasions.

NEW BUSINESS GAINS OF BYLLESBY PROPERTIES.

All electric properties of H. M. Byllesby & Company reporting for the week ended May 18 show the following new business gains (net): Three hundred customers, with 297 kilowatts of lighting and 3606 horsepower in motors. New business contracted for includes 1064 customers, with 506 kilowatts of lighting and 3736 horsepower in motors. Electric energy output shows an increase of 18.9 per cent over the corresponding period last year.

DIRECT AND ALTERNATING-CURRENT MOTORS IN SHOP WORK.

How Central-Station Service Is Applied in Chicago Works of Sullivan Machinery Company.

By W. A. Scott.

The utilization of direct-current motors for individual drive and alternating-current for group drive may be seen in practice at the shops of the Sullivan Machinery Company, 2624 West Lake Street, Chicago. Commonwealth Edison service is supplied at 2300 volts, alternating current, to the bank of transformers on the premises. There is a connected load of about 875 horsepower, about 500 horsepower being for direct-current and 375 for alternating-current motors. Included in the former is 200 horsepower in alternating current for a motor-generator set by which it is converted to direct current for driving the larger shop tools. The motor-generator set comprises a 200-horsepower motor and a 175-kilowatt generator. It may be explained that formerly the heavy tools in the older part of the shops were driven by direct-current electric power produced in the plant, in which the gen-

Motor-Driven Planer Performing Three Operations Simultaneously.

erator above mentioned was steam-driven. When it was later decided to take on central-station service the plan of coupling a 200-horsepower motor to the generator to convert alternating to direct current was put in effect. The main purpose in this was to be able to obviate shop changes where a large number of tools were connected up to direct-current motors. The direct-current motors are operated at 110 volts, nearly all of which drive machines that require variable speed. The alternating-current motors operate at 440 volts. The largest motor of this class is one of 250 horsepower for driving an air compressor, used in making air-compression tests on newly-built compressors. This compressor formerly was steam driven. Other alternating-current motors are utilized for both group and direct drive in the newer shop sections.

Use of Variable-Speed Motors.

The larger shop tools, in the section where direct-current motors are used, consist of boring mills, planers, lathes and radial drills, required in the building of air compressor cylinders, drums and cylinders for heavy hoists and other equipment. These tools require a wide range of speed variation, and are served by two 20-ton traveling cranes operated by direct-current motors.

Without attempting to give details concerning each of this class of shop tools, a few facts may serve to show some of the shop features. For instance, a radial drill press, run by a 5-horsepower, variable-speed motor, is equipped with a General Electric drum controller, with armature resistance for motor starting; also shunt-field resistance for regulating the speed as may be required for the work in hand. Other tools are similarly equipped, as in the case of a Niles horizontal boring mill for making air-compressor cylinders. In a vertical boring-mill installation, the 10-horsepower motor is equipped with a Cutler-Hammer speed controller, whereby 20 or more different speeds may be obtained within the range of work that may be done. A Cutler-Hammer rheostat is also provided for starting.

Two boring mills, each driven by a 15-horsepower motor by means of triple-gear connections, are given a variable range of speed of 16 feet per minute up to as high as would be practicable for the machine to move in the work required. A heavy planer, the largest in the shop, and illustrated herewith, is driven by a 30-horsepower motor, connected by a chain belt to a shaft, with a belt from the shaft flywheel to the driving pulley. The relative size of this machine is shown in the illustration. The speed and economy of its work are indicated by the number of compressor parts being machined at the same time.

The largest boring mill in the plant is the vertical type, capable of covering an 18-foot diameter piece of work, is operated by a gear-connected 30-horsepower motor having a speed variation of 15 to 60 feet per minute. There is also an auxiliary motor used in making adjustments to the various kinds of jobs.

Each of the several 20-ton cranes is equipped with a 10-horsepower direct-current bridge motor, besides the hoist motor. These are Pawling & Harnischfieger cranes.

View of Shop Showing Absence of Overhead Belts and Shafts.

Motor-Driven Boring Mill with 18-Foot Flywheel on Bed.

Alternating-Current Motors for Line Shafts.

That section of the works served mainly by alternating-current motors occupies two floors, each similarly equipped. On each floor are two line shafts, the full length of the shop, each driven by a 30-horsepower 440-volt, 3-phase motor, by which such tools as lathes, drill presses, shapers and planers of the smaller sizes are operated in groups. Mining machinery castings are machined here, among which being diamond drill and air-drill parts. Besides the tools driven from the line shafts, there are a number which have direct, individual drive in which 7½-horsepower, direct-current constant-speed motors are used.

A steam plant is maintained for heating purposes and for operating the air compressors and steam hammers required in the shop work.

ELECTRICAL EXPORTS FOR MARCH WERE UP TO AVERAGE.

The official summary of the foreign commerce of the United States for March just issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., shows that the total value of electrical shipments was practically equal to that of March a year ago and above the monthly average of recent months. It was exceeded, in fact, by the figures for only four other months. The following table gives the classified comparative figures for last March and for the corresponding month of last year:

Articles.	March, 1918.	March, 1917.
Batteries	$ 289,251	$ 380,992
Carbons*	181,617	.....
Dynamos or generators	269,409	132,760
Fans	65,643	18,004
Heating and cooking apparatus*	31,553	.....
Insulated wire and cables	536,247	719,639
Interior wiring supplies, including fixtures	129,703	80,579
Lamps—		
Arc	2,001	4,015
Carbon-filament	8,840	12,505
Metal-filament	236,817	176,577
Magnetos, spark plugs, etc.*	318,333	.....
Meters and measuring instruments	125,207	99,509
Motors	785,233	572,733
Rheostats and controllers*	29,429	.....
Switches and accessories*	222,338	.....
Telegraph apparatus, including wireless	15,429	135,775
Telephones	368,338	151,739
Transformers	95,325	116,347
All other	1,437,208	2,597,989
Total	$5,147,921	$5,199,163

*Not separately listed prior to July 1, 1917.

Better Lighting of Machine Shops

Imperative Need for Improved Lighting—Numerous Benefits Resulting Therefrom—Its Low Cost—How Poor Lighting Can Be Quickly Recognized—Requirements of a Good System

By F. H. BERNHARD

This is the first of a series of twelve articles dealing with improved lighting in as many industries. These articles show the peculiar timeliness of improving industrial lighting just now, which can be done at very low cost compared with the valuable results it brings about. Suggestions are given for securing a satisfactory lighting system. The articles have been written intentionally in a non-technical style as far as practicable, so they may be read with profit by the owners and managers of industrial plants who in so many cases still need to be educated on this important subject.

LIGHT is a very important factor in manufacturing. Before the use of artificial light all work ceased when daylight failed. As lamps came more and more into use in factories the loss of time caused by periods of darkness during working hours was gradually diminished. This loss of time, due directly to inadequate or generally poor lighting, is still very serious in most factories, however. Improved machinery has quickly superseded old tools and machines, but modern lighting is not yet common in the average shop.

At a time when over two million men in this country have left their former places of employment to join the Army or Navy, or shifted their work to shipyards, arsenals, and the like, and when it is quite certain that several other millions will leave within a year, the factory manager is confronted with the perplexing problem of maintaining production with greatly reduced forces of skilled men and with many new and untrained employees. A scientific lighting system helps materially to overcome some of the difficulties thus arising. Moreover, it enables overtime work or operation with two or three shifts to be carried on efficiently, so as to fulfill rush orders or large contracts without prohibitive heavy investment in new shops and equipment.

Thousands of our factories are already working on government contracts and before another year is gone many thousand additional shops throughout the country will be called on to adapt themselves, as they have in England and France, for turning out the enormous supplies needed to maintain our increasing Army and Navy at the front. High quality and rapid production will be demanded of all these plants. A prime requisite for such production is an abundance of properly directed illumination. From this it is evident that factory lighting is more deserving of consideration now than ever before.

Chief Beneficial Results of Improved Factory Lighting.

The valuable effects of good lighting, both natural and artificial, have been well summarized in the Factory Lighting Code of the Illuminating Engineering Society. The resulting benefits are given as follows:

(1) Reduction of accidents.
(2) Greater accuracy in workmanship.
(3) Increased production for the same labor cost.
(4) Less eye strain.
(5) Better working and living conditions.
(6) Greater contentment of the workmen.
(7) More order and neatness about the plant.
(8) Supervision of the men made easier.

These benefits are closely interrelated, as shown diagrammatically in Fig. 1. They can be roughly divided into two groups: First, improvement in the quality and quantity of the product; second, improvement in the condition of the workmen. The former is of direct concern to the employer; the latter, while of immediate concern to the employee, is also of importance to the employer; indeed, progressive employers now recognize that attention to the human

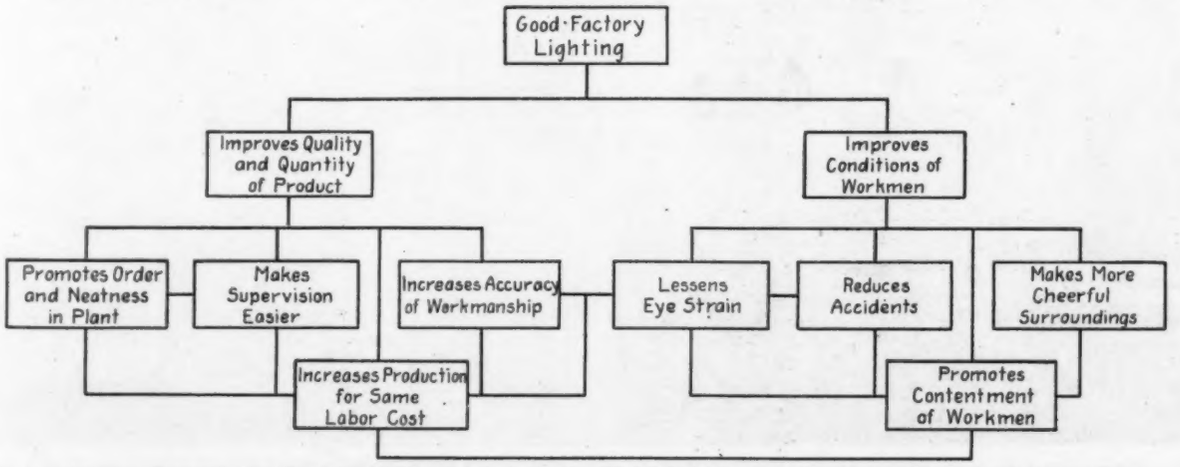

Good Factory Lighting
Improves Quality and Quantity of Product
Improves Conditions of Workmen
Promotes Order and Neatness in Plant
Makes Supervision Easier
Increases Accuracy of Workmanship
Lessens Eye Strain
Reduces Accidents
Makes More Cheerful Surroundings
Increases Production for Same Labor Cost
Promotes Contentment of Workmen

Fig. 1.—Diagram Showing the Benefits Resulting From Good Factory Lighting and Their Classification and Interrelation.

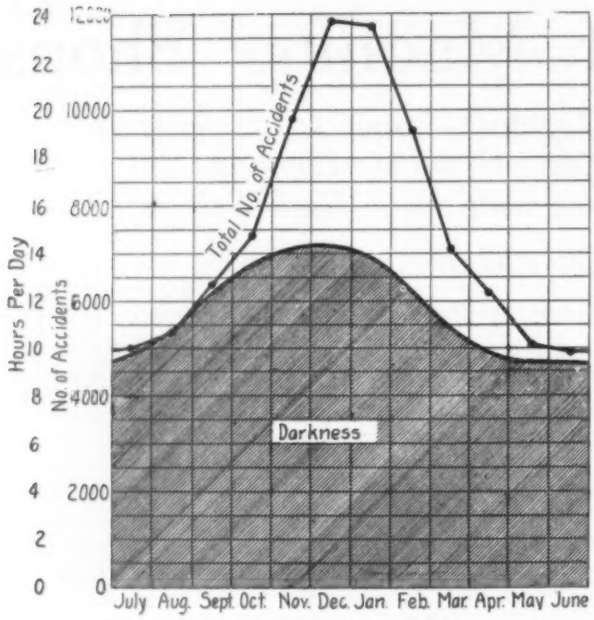


Fig. 2.—Curve of Monthly Distribution of Industrial Accidents Reported to a Large Accident-Insurance Company and How This is Affected by Darkness.

The shaded area shows hours of darkness from sunset to sunrise. There are actually many more dark hours due to cloudiness interfering with sunlight. No data were available on this. If the cloudy hours are superposed on the totally dark hours, the effect of darkness on accidents is still more markedly shown.

needs of the workmen, even when prompted by the altruistic dictates of common humanity, shows excellent returns in both volume and character of the work performed.

On account of the seriousness of the labor supply problem and its relation to production, it will be of timely value to touch briefly on how improved lighting results in better quality and increased quantity of product.

Improvement in Quality and Reduction of Spoilage.

It is well known that a new employee will make mistakes even after he has been instructed in his work. The novelty of his surroundings and unfamiliarity with all details of the work leaves him often figuratively in the dark and errors naturally result. But how much more so does this happen when he is literally in the dark—a poorly lighted shop. Countless mistakes are then bound to occur; many of these can be partly recompensed by placing the product among "seconds"; but many blunders result in absolute waste of much valuable material and costly finishing work. Clearly, the best possible lighting is necessary to aid the green hand, so that he or she will not turn out inferior or entirely spoiled work.

Even a skilled mechanic is likely to make costly mistakes due to poor lighting. An order or blueprint may be read wrong or a micrometer incorrectly set because of dim or improper light. For instance, cases have occurred where an entire batch of shafts were turned several thousandths of an inch too small and therefore had to be thrown into the scrap heap. In every machine shop mistakes even more serious have occurred and many of these were directly due to inadequate light. Mistakes always represent some loss and this is increased at times, like the present, of high costs of material and labor.

In a shop making shells, guns or other ordnance supplies the highest workmanship and precision of work is required. Parts must be accurate to a thousandth of an inch or even less in order to fit with parts made in other shops. Inspection is necessarily very rigid because inaccurate parts are worthless to the Government and are rejected at heavy loss to the manufacturer. Even in normal times the loss from

Fig. 3.—Excellent Machine Shop Lighting in Plant of Davis Manufacturing Company, Milwaukee. No Dark Corners or Troublesome Shadows. Every Part of Shop Is Evenly Lighted.

spoilage runs into many millions of dollars annually in this country.

Little argument is needed to show that abundant north-sky daylight on a set of machine tools will enable the men to produce more accurate and in every way superior work than if they had to work in a poorly lighted shop. Likewise, by providing modern, efficient and well distributed artificial light it is found that the work turned out at night or at any hour of sudden darkness is of as high quality as that made in bright daylight. Such lighting has been found to reduce spoilage on the average about 25 per cent.

Increased Quantity or Rate of Production.

The demand of the hour is for increasing production at as little additional cost as possible. Rate of production depends directly on efficiency of the men and the machinery and tools they work with. A dull tool is not tolerated; an obsolete, inefficient machine is quickly thrown out. Light is in a sense a tool, an important tool in production. Without it no work is done, the more we have of it (up to the standard of north-sky daylight) the more work is done. Poor light like a poor tool means much loss of time.

The increase of production, which has been repeatedly demonstrated as due to good lighting comes chiefly from elimination of lost time. It is obvious that in a poor light a workman will take much more time to adjust a micrometer caliper, or set a milling machine, for instance, than where he has abundant and well directed light; it is the same proposition as trying to read small print or thread a needle at twilight compared with midday. Observation has shown that in a dimly or very unevenly lighted shop much time is lost in groping around for tools and materials, and in walking back and forth to the window or other brighter area to read scales or blueprints, or to examine nearly finished work, etc. There are hundreds of

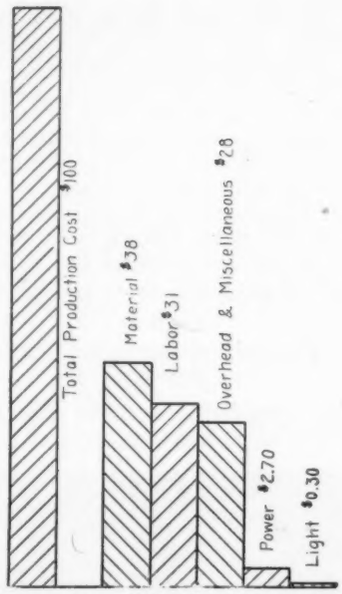


Fig. 5.—Analysis of Daily Production Cost in Section of a Machine Shop, Showing That Lighting Costs Only 1 Per Cent of Wages and But a Trifling Part of Total Cost.

such lost motions in the average shop that is poorly illuminated.

This lost time has been found to aggregate in various shops from 5 minutes up to 2 hours or even more per worker per day, depending on the nature of the work and the poorness of the lighting. The latter serious and at first seemingly impossible time loss has been found in several cases where the men lost fully an hour each in the early and late part of dark, cloudy days, due to the entire absence or meagerness of artificial light.

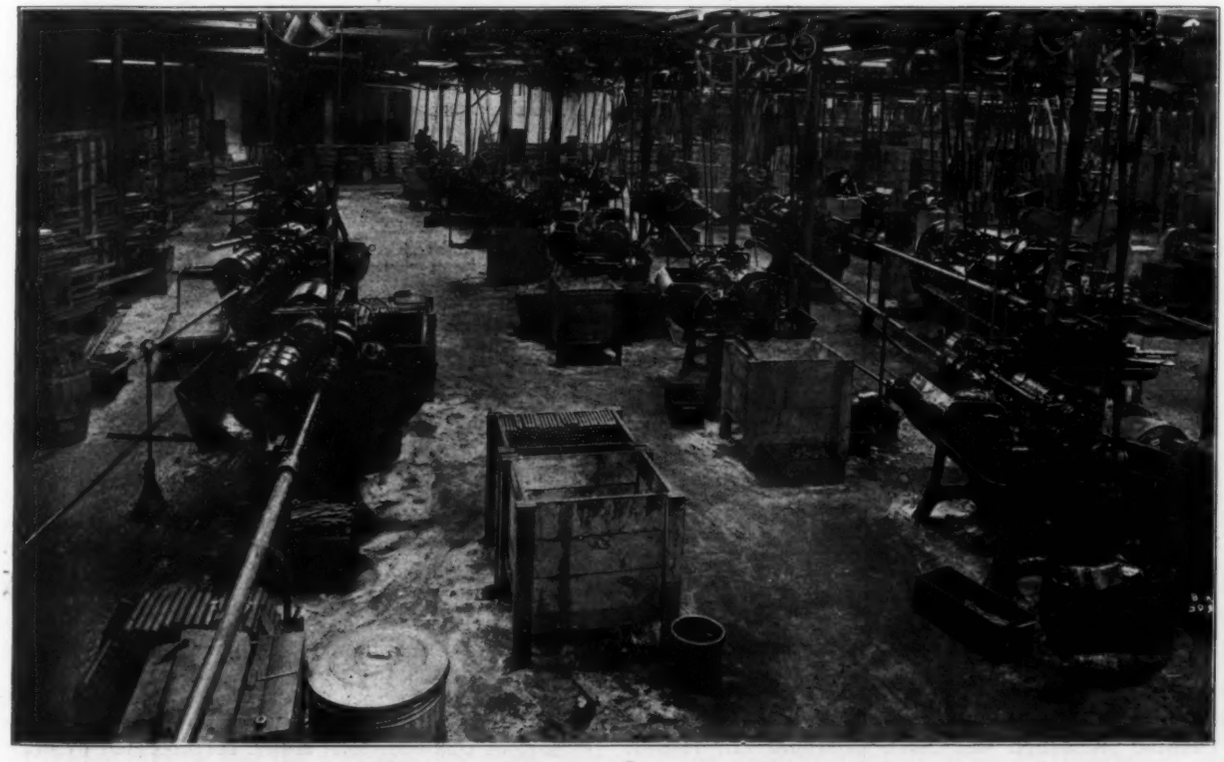


Fig. 4.—Another View in Davis Manufacturing Company's Shop. Overhead General Illumination From Mercury-Vapor Lamps. No Drop Cords Are Needed in Such a Well Lighted Shop.

Most of the other benefits of good lighting have a direct bearing on the reduction of time loss and increase of production or else indirectly affect it by stimulating the efficiency of the men, as shown in Fig. 1. Better supervision in the shop brought about by improved general lighting decreases loafing and "killing time." A neat and orderly shop permits things to be found without long search. Reduction of spoilage, already referred to, means a direct increase in production. Lessened eye strain from inferior lighting makes more efficient workers, as does the cheerful atmosphere of a well lighted shop and the increased contentment of the men.

Extent of Production Increase From Improved Lighting.

From the foregoing it is to be expected that the increase in rate of production brought about by improved factory lighting should be quite appreciable. Indeed, it is, although accurate figures are difficult to obtain because of constantly varying conditions in a shop. To make an exact test of the increase it is necessary to keep close tab on the production for a period of time long enough to obtain a good average of the rate under the old lighting, then for a similar period under the improved lighting with the same workmen, same kind of work, same machines, practically the same kind of weather, etc. However, numerous observations have been made, which have unmistakably proven the stimulating effect of good lighting.

The results of these observations on actual installations show the rate of production to increase from 5 to 10 per cent on a very conservative basis in the average shop. Many reports give 10 per cent, some much higher, few as low as 2 per cent. In a recent test in a large Chicago machine shop the increase ranged from 8 to 27 per cent in eight different machine operations, the average being 15 per cent; every possible precaution was taken to secure fair results. Another recent and extremely interesting case was that in a small shop making concrete mixers. The building was old and poorly lighted. A modern lighting system was put in one-half of the shop. After three weeks the owner insisted on the other half being similarly equipped. He had formerly turned out an average of three and a half machines per week; with the improved lighting in half his shop he turned out five machines a week, an increase of about 43 per cent! It is just in such relatively small and poorly housed shops that the worst lighting conditions prevail, many parts being in gloom even on a bright day.

Reduction of Accidents.

One of the heavy drains on the management of industrial plants has been the large number of accidents. Entirely aside from humane and legal considerations, accidents upset the working organization, interfere with production schedules, and are costly. The subject of industrial safety has been given much study in recent years, with the result that it has been positively shown that accidents are much more numerous in the dark months of winter than at any other time of the year.

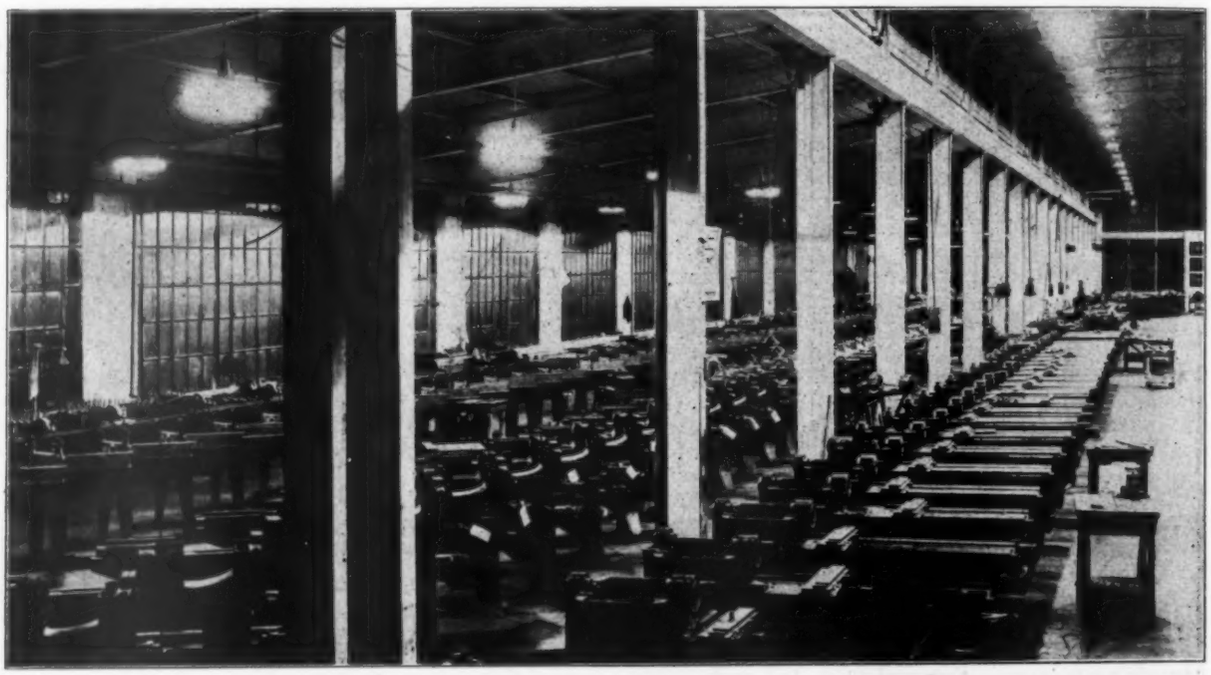


Fig. 6.—View of Half of Main Assembling Room in Foster Machine Company's Plant at Elkhart, Ind. An Abundance of Light in Every Part of the Room.

The monthly distribution of industrial accidents reported by a large accident insurance company for a typical year before the war is shown in Fig. 2. This shows that in December and January the number of accidents was over 135 per cent greater than in June and July. Superposed on this illustration is a shaded curve showing the number of dark hours from sunset to sunrise throughout the year. This shows that the greater number of dark hours on winter days has an important bearing on the occurrence of accidents. Detailed analysis of the reports proved this conclusively, the number of accidents stated as directly due to darkness or insufficient light being more than 3½ times as great in winter than summer, some 3300 were actually reported from this cause in December alone. In many of the accidents ascribed to some other cause darkness was believed to have contributed. The conclusion of this analytical study, corroborated by other accident and safety experts, is that good lighting should eliminate nearly 25 per cent of all such accidents.

It is evident that inability to see an unexpected

obstruction in a dark path readily results in a more or less serious fall. Similarly, poor light prevents the workmen from avoiding other dangers. Usually it is a matter of inadequate light, although not infrequently it is the partial blindness caused by an unshaded glaring light in the field of vision, such as the still common drop light, that causes the workman in an unguarded moment to forget the danger of the gear, belt or cutting tool.

A modern system of good general illumination eliminates unevenly lighted areas and dark corners so that dangers are exposed instead of hidden. It also avoids the serious glare that dazzles and fatigues the eyes so that they are incapable of observing hazards that would be instantly detected with the eyes in a normal condition. A reduction of some 25 per cent or more in accidents by good lighting is therefore not unreasonable. And considering the small cost of such lighting it is a splendid investment in showing the men that their welfare is thought of.

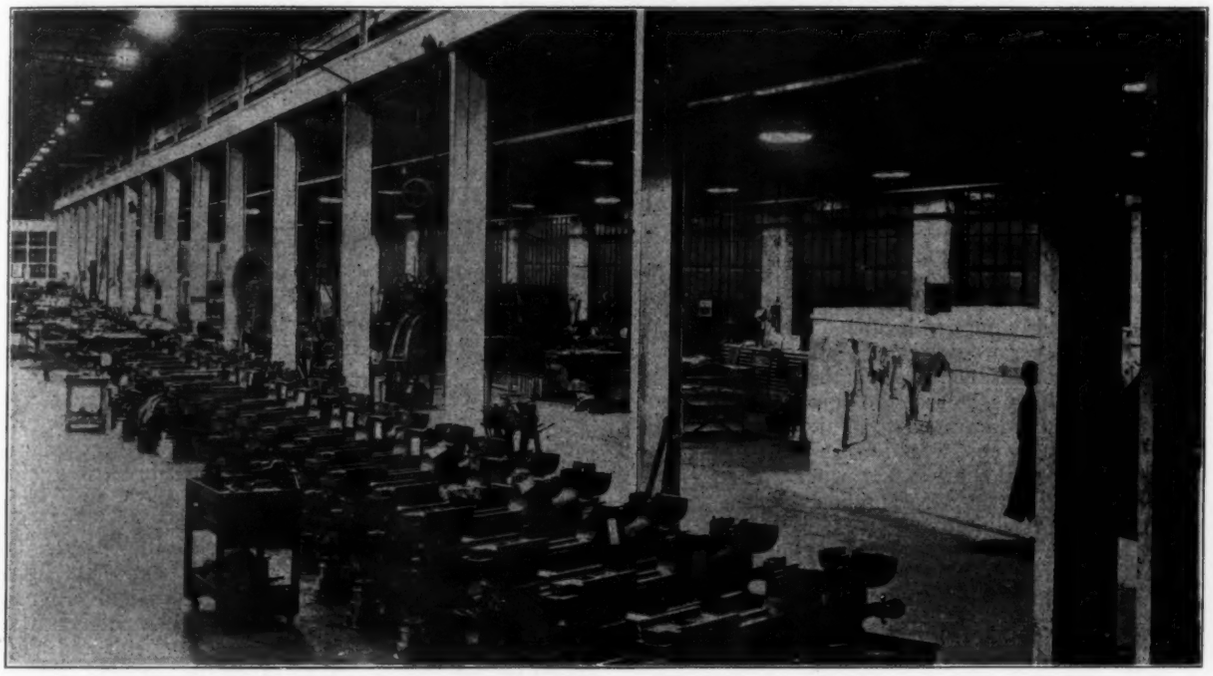


Fig. 7.—Other Half of Foster Machine Company's Main Assembling Room. Excellent General Illumination From Mazda C Lamps Overhead.

Increased Contentment of Workmen.

The manufacturer who shows humane regard for the comfort and welfare of his men will in the long run profit by their increased loyalty and efficiency. A shop in which the men are in constant dread of serious accidents, where the prevailing darkness casts a gloom over all employees, where long continued eye strain causes persistent headache and fatigue, is a shop that will be shunned or the men remaining at work will be in a continual state of discontent.

Before closing this discussion of the benefits of good shop lighting, it is therefore desirable to point out briefly the contrasting effect it will produce. The cheerful surroundings of a well lighted, orderly shop have a wholesome psychological effect in dispelling gloom just like sunshine drives away the depression of a dark, cloudy day. A good working light does not strain the eyes, so that the workman may come home fit to read and enjoy the company of his family instead of with a bad headache and irritable disposition. Such a workman will not only be much more efficient, but also more contented and loyal. In these days when skilled men are in such great demand and when it is practically impossible to replace them effectively, it is indeed desirable to promote contentment among them.

The Low Cost of Good Shop Lighting.

In the foregoing review of the numerous advantages of good lighting it was shown that they are far reaching even in normal times, but especially so at an abnormal time like the present. It was already intimated that the cost of good lighting is very low. It is, in fact, almost trivial compared to the benefits it brings about, so that no factory owner should forego availing himself of its valuable aid in reducing the difficulties now confronting him.

A condensed graphic analysis of manufacturing cost in one division of a machine shop is shown in Fig. 5. This shop finishes steel castings and the particular division includes seven machinists now paid $4.40 each per day. The diagram shows the daily costs in round numbers. This particular case is typical of shops where some effort has been made to provide lighting, but not on modern scientific lines, carbon lamps on numerous drop cords being largely used. The lighting cost here is considerably higher than that of an equivalent efficient system, but at that is only about one per cent of the wages of the men. This lighting cost includes the energy charge for operating the lamps used in the division, occasional cleaning and renewal of lamps, interest and depreciation.

The diagram shows very forcibly how very small a part (in this case 0.3 of 1 per cent) the cost of lighting is of the entire production cost. In the case illustrated each man receives a trifle under one cent per minute on an eight-hour day basis, whereas the cost of lighting per man for the entire day is about 4¼ cents, or equal to about 4½ minutes of his wages. If the lighting, even as it stands, saves 4½ minutes of his time a day, it pays for itself entirely.

Let us consider the cost of a new and up-to-date lighting system compared with that now in service,

which as already mentioned is not efficient and provides inadequate and uneven illumination. If the carbon lamps were replaced by the same number of Mazda lamps of equal candlepower, the total lighting

Fig. 8.—View of Part of the Tool Room, Foster Machine Company. Exacting Work Can Be Done Under Such Illumination.

cost could be diminished over one third. However, since drop lamps, poorly equipped as to shades and reflectors and poorly placed, are in use, it will be by all odds the best plan to discard all the old equipment and put in a good system of general lighting with reflector units near the ceiling and supplemented only where necessary by well equipped localized units.

Such a system would employ Mazda lamps of higher candlepower and much higher efficiency than the old carbon lamps, so that the new equipment could be installed at no increased total lighting cost, since the lower operating cost would make up for the higher interest and renewal charges. However, let us assume that the factory owner was convinced that improved lighting is a splendid investment and was therefore willing to have three or even four times more light provided than formerly. This could be readily done at an increase in the lighting cost of not over 20 per cent at the most. Such improved and increased lighting should result in an increase of production of 10 per cent; this is a very conservative figure, since in a somewhat parallel case a new lighting system involving an increased cost of only 2 per cent gave an increased production rate of 10 per cent. The comparative daily costs, based on the data of Fig. 5, would then be as follows:

	Original System	New System	Increase Per Cent
Light	$ 0.30	$ 0.36	20
Power	2.70	3.00	10+
Overhead	28.00	28.84	3
Labor	31.00	31.00	0
Material	38.00	41.80	10
Total	$100.00	$105.00	5
Output	100%	110%	10

In this comparison power and material are figured at the same increase as the total production. An increase of 3 per cent is included in overhead to allow for additional wear and tear on machinery and tools and other items involved in taking care of the 10 per cent added material and finished product. There is no increase in labor charge because of the higher efficiency of the men and elimination of much lost time due to the better lighting. The striking thing in this table is that the additional 20 per cent for lighting costs but 6 cents a day for this division with its seven men, yet it produces an added 10 per cent in the product at an increase in total cost of but 5 per cent.

No further comment is necessary. These figures speak for themselves and clearly show that the cost of lighting is extremely low in any case relative to total production cost and the added cost of a highly improved lighting system is truly negligible compared to the value of the added resulting output, not to mention the incidental benefits already referred to.

Earmarks of a Poor Lighting System.

Having set forth the numerous advantages and profitable character of a good shop lighting system, and possibly convinced the reader of its desirability, the question may arise, how do I know that the present system is not amply satisfactory for the purpose? Of course, a lighting expert could by a rapid inspection of the shop answer the question authoritatively, but how can the factory owner or manager convince himself?

In the first place, there are many indications of a poorly maintained system, one that therefore does not yield the results it is capable of. Empty lamp sockets yield no light, yet they are very common in the average shop. Dirty lamps and reflectors are equally common. It is as necessary to clean a lamp to let its light shine out freely as it is to clean windows to let daylight enter the shop freely. Reflectors, also, are efficient only when clean and placed in proper relation to the lamps they are designed for; it is not uncommon to find reflectors crookedly mounted, bent or even partly broken. If gas lighting is used, it is exceptional to find all mantles unbroken, burners properly adjusted and glassware intact.

Poorly equipped systems are also frequently detected at a casual glance. Carbon-filament lamps are inexcusable nowadays when efficiency is everywhere called for; a Mazda lamp will produce three times the candlepower for the same current. Bare, unshaded lamps are also inefficient; first, because over half of their light shines on the ceiling or in other nonuseful directions; second, because a bright exposed light source in the field of vision partly blinds and fatigues the eye, just as bright sunlight does when entering the eye directly, only the action is not so violent and may go on over a long period injuring the eyesight unconsciously. Misfit or wrongly combined lamp and reflector sizes are also quite common, although possibly not so readily detected except when a very large lamp projects much below too small a reflector.

The system is often poorly laid out and therefore both ineffective and inefficient. If it consists mostly of drop lights this is certainly true, because they are the worst offenders in lighting equipment in throwing the light into the eyes of the workmen instead of upon the work. Moreover, in the absence of an auxiliary set of well distributed ceiling lamps for providing general illumination, drop lights leave dark zones about machines, piles of castings, etc. Furthermore, drop lights are hard to keep properly maintained. Absence of general lighting almost invariably means unevenly distributed lighting, great contrasts between bright and adjoining dark areas, and a generally gloomy and depressing aspect to the shop, all of which help cause eye strain, accidents and discontent.

Evidence of a generally poor lighting system can often be found in the strained and dejected appearance of the workmen that accompanies continual eye strain, also in the tendency to tire readily and "kill" time. If the ventilation and temperature of the shop are satisfactory and the foreman congenial, it is fairly

certain that faulty lighting is to blame. Even on bright days the lighting may be very inadequate in parts of the shop remote from the insufficient and probably dirty windows so commonly found in most old shops. If additional daylight can not readily be provided, artificial light should then be used even at midday, since its cost has already been shown to be almost trivial.

Requirements of a Good Lighting System.

Some of the elements of what should constitute a good lighting system have already been hinted at. They have been probably best summarized in the Factory Lighting Code of the Illuminating Engineering Society as follows:

"1. Sufficient illumination should usually be provided for each workman irrespective of his position on the floor space.

"2. The lamps should be installed and selected so as to avoid eye strain to the workman.

"3. The lamps should be operated from sources of supply which will insure reliable illumination results, particularly on account of the demoralizing effect produced by intermittent service, just when the light may be most needed.

"4. Adequate illumination should be provided from overhead lamps so that sharp shadows may be prevented as much as possible, and in such measure that individual lamps close to the work may be unnecessary except in special cases.

"5. The type and size of lamp should be adapted to the particular ceiling height and class of work in question.

"6. In addition to the illumination provided by overhead lamps, individual lamps should be placed close to the work, if they are absolutely necessary in the opinion of a lighting expert, and in such cases the lamps should be provided with suitable opaque refletcors."

The first requirement means that the illumination must be adequate for the work to be done and regardless of the possible shifting about of machines, work benches, etc., which is not uncommonly done, it must also be ample in aisles between machines, on stairways, etc. What comprises adequate illumination will be discussed later on. The only satisfactory way of providing adequate illumination on all parts of machines and in the spaces about them even if they have been moved, is to have a lighting system installed on the ceiling and arranged to give general illumination over the entire floor area.

The second requirement substantially bars the old type of unshaded drop light and means that no bright light sources shall be exposed in the ordinary field of view. If part of a pendent lamp is exposed below the edge of its reflector, the unit must be hung as high as possible above the field of vision. If the machine or work has highly polished surfaces of any extent, a special type of lighting unit to give a diffused light source may be necessary to prevent dazzling reflections of too concentrated a source. This is the same problem as requires the pulling down of sunshades to avoid dazzling direct sunlight falling on the work near windows.

Lighting feeders separate from power feeders meet the third requirement. If power and light are supplied from the same feeder, there is first the annoying voltage fluctuation caused by changes of the power load, which results in unsteady light, and second the opening of a fuse in the feeder due to sudden violent overload or short-circuit in a motor results in putting all lights out.

Some of the considerations mentioned under the first requirement also cover the fourth. This, however, definitely urges the provision of liberal general illumination so that the objectionable drop lamps may be entirely done away with.

By the fifth requirement it is hoped to overcome the glaring examples of poorly selected lamp and reflector equipment one meets with occasionally. Detailed advice on what is a suitable combination can be had from consulting illuminating engineers, if the problem is a difficult one, or from the engineering departments of the more progressive lighting companies, and manufacturers of lighting equipment, and also from the more enterprising electrical contractors.

The sixth requirement again advises against the use of local lamps except where it is absolutely necessary to look into cylinders, internal gears and other parts that can be illuminated in no other way. The common prejudice in favor of individual lamps for each workman is only a relic of a bad habit resulting from the shortcomings of the early methods of shop lighting with a few expensive arc lamps that required supplementing with numerous small incandescents then available in order to illuminate the tools and working area properly.

The large range of sizes of tungsten lamps now available, all of which are highly efficient lamps, readily adapt themselves to meet any requirement in shop lighting. Then too there are available mercury-vapor lamps that are also very efficient and excellently suited to machine-shop lighting, especially where work of

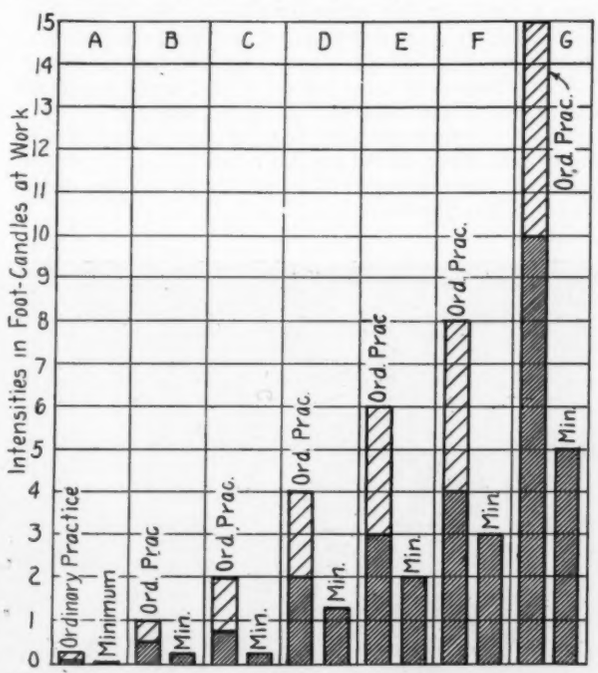


Fig. 9.—Illumination Intensities Recommended. Based on Revised Factory Lighting Code of Illuminating Engineering Society.

	Areas or kind of work to be illuminated.	Foot-candles at the work. Ordinary practice.	Minimum.
A	Roadways and yard thoroughfares.	0.05— 0.25	0.02
B	Storage spaces	0.50— 1.00	0.25
C	Stairways, passageways, aisles	0.75— 2.00	0.25
D	Rough manufacturing, such as rough machining, rough assembling, rough bench work	2.00— 4.00	1.25
E	Rough manufacturing, involving closer discrimination of detail	3.00— 6.00	2.00
F	Fine manufacturing, such as fine lathe work, pattern and tool making	4.00— 8.00	3.00
G	Special cases of fine work, such as watchmaking, drafting	10.00—15.00	5.00

great accuracy, requiring high acuity of vision and discernment of fine detail is carried on. The use of arc lamps is rapidly diminishing due to the superiority of these newer lamps. Consequently, the reasons for using localized lighting to any extent have vanished and the higher efficiency, lower total cost and improved satisfaction obtained by general illumination is bringing it rapidly to the front.

Some Considerations to Observe in Laying Out a Shop Lighting System.

Before mentioning some precautions in laying out a new system, it is to be strongly recommended that this be done by an engineer, lighting expert, or contractor experienced in such work. If maximum satisfaction is to be obtained from the new system, its design should not be left to an inexperienced person. A good system requires knowledge of many technical points that are fully understood only by those that have given special study to them. The disappointment resulting from numerous poorly designed installations is evidence of the folly of expecting good results where scientific considerations have been given no thought.

One of the first things to do is to study the particular requirements of the work to be done and the conditions peculiar to the room where it is done, as to dimensions, height and kind of ceiling, location of windows, columns, doors, machinery, etc.

The lighting, of course, must be adequate for each kind of work. Adequacy of illuminating involves primarily abundant intensity. Illuminating engineers have a unit for this intensity that is called the foot-candle, which is the illumination on a surface produced from a standard candle placed one foot away from it. A 16-candlepower lamp placed 4 feet from a surface also gives it an intensity of one foot-candle. The intensity recommendations for different kinds of machine-shop work, based on the revised Factory Lighting Code already referred to are given in Fig. 9 and the table directly below it.

These intensities are all in foot-candles at the working plane, which is taken as 30 inches above the floor. The minimum values are practically those now required in the Factory Lighting Codes of Pennsylvania and New Jersey. Ordinary practice usually agrees with those given except on special fine work where the desirable practice in each case is considerably higher in view of the better results obtained. In any case the effort should always be to at least equal the higher values given for ordinary practice, if not exceed them. Installations wherein they have been materially exceeded have yielded excellent returns.

An idea of the amount of electrical energy required to give the foot-candle intensities recommended may be obtained from the following: For an installation of modern lamps spaced so as to average one candlepower per square foot of floor area, mounted 12 to 16 feet above the floor and equipped with efficient reflectors, the average effective illumination will be about 3 foot-candles. Such lamps will have an efficiency of a little over 1 to a little less than ½ watt per candle, depending on the type and power of the lamp. To find roughly the watts required per square foot of floor area, divide the desired foot-candle intensity by 3, and multiply by the efficiency of the lamp chosen.

Allowance must be made for reduction of the efficiency of the unit due to accumulation of dust and dirt on the lamp and reflector, also due to the gradual depreciation of the lamp itself. This means that the initial candlepower must exceed by 20 to 50 per cent the desired or calculated candlepower, depending on the maintenance the equipment will receive.

Having studied the local requirements and the illumination intensities to be used, the size and number of the lighting units is determined by methods well known to lighting men that need not be explained in detail here. The units in modern installations are practically always selected to be of uniform size and arrangement throughout a floor, unless special requirements are to be met. Judgment must be used in select-

Fig. 10.—Heavy Machine-Tool Section of Hanna Engineering Works, Chicago. All the Light for This 300 by 50-Foot Room Is Furnished by 14 Powerful Reflector Units Hung in Center of Ceiling Directly Over the Crane.

Fig. 11.—Machine Shop of Benjamin Electric Manufacturing Company, Chicago. Small Mazda C Lamps With Enameled-Steel Reflectors Illuminate Every Part of Room Uniformly.

Fig. 12.—Part of the Machine Shop of Federal-Huber Company, Chicago. Every Machine and Space About It Is Well Lighted by Deep-Bowl Reflector Units.

ing a lamp size and mounting height to give the illumination desired when equipped with correspondingly suitable reflectors.

As to reflectors, equal judgment is necessary. The reflector chosen must be suited to the lamp and light distribution selected; it must possess durability of the reflecting surface, high efficiency, ability to be easily cleaned; it should also protect the eyes from seeing any part of the bare, brilliant lamp, unless the unit is hung close to a very high ceiling so as to be above the range of ordinary vision.

Reflectors for machine shop lighting are commonly made of steel with white porcelain enamel or aluminum interior finish, and also of glass with refracting prisms or silvered mirror as the reflecting surfaces. The objection raised to the use of glass reflectors on account of liability to breakage is readily overcome by mounting them close to the ceiling. Special forms of reflectors designed to minimize glare from the lighting unit have recently been developed and their use is well warranted where this objectionable element must be almost entirely overcome, as is the case where work is done on highly polished machines or working surfaces. Cheap forms of reflectors, such as the common tin cone with white painted interior surface, are not to be recommended because of their poor efficiency and low durability.

Typical Installations of Good Machine Shop Lighting.

Almost countless installations could be cited of good examples of machine shop lighting. Space permits mention of only a few recent installations in which noteworthy features are present.

Two views in machine shops of the Davis Manufacturing Company, Milwaukee, Wis., are shown in Figs. 3 and 4. This company makes gasoline engines and has its entire plant lighted with Cooper Hewitt lamps, including both foundry and machine shops. In the former, 130 direct-current lamps illuminate 52,000 square feet of area at an energy consumption of 1 watt per square foot. In the several machine shops and assembling rooms there are 240 alternating-current lamps lighting 72,000 square feet at the rate of 1.27 watts per square foot. These lamps are 12 feet above the floor and each is in the center of a rectangle 15 by 20 feet. The illustrations show the excellence of the illumination, which is ample for all the operations of general fine machine-shop work, including cam and crankshaft grinding, tool-room work, etc. No drop lights are used or found necessary.

Figs. 6, 7 and 8 show views in the shops of the Foster Machine Company, Elkhart, Ind. This company manufactures turret lathes and screw machines. The main assembly room is shown in the two larger illustrations. The entire room is lighted by 300-watt Mazda C lamps with two types of reflector equipment. The middle section has enameled-steel reflectors of the deep-bowl type. Both side sections have a special type of reflector with a silver cap covering the tip of the lamp so that no portion of the filament can be seen. In the center the units are 32 feet high and placed at the centers of rectangles 15 by 17 feet. A portion of the tool room is shown in Fig. 8. This has 200-watt lamps 12 feet above the floor. Each unit is equipped with the special type of reflector and cap mentioned above, some 400 units of this type being used throughout the plant. Very satisfactory illumination is obtained in every shop. There is an absence of annoying shadows, as well as of troublesome glare and abundant light is furnished to require no localized lighting.

Fig. 10 shows a view in one of the larger machine shops in the Hanna Engineering Works, Chicago. This room is 300 feet long by 50 feet wide. It was formerly lighted by means of 14 arc lamps recessed in special asbestos-lined pockets set into the ceiling directly over the traveling crane. Each arc was replaced by a 750-watt Mazda C lamp with a silvered-mirror glass reflector. Each of these 14 units was placed in the former arc-lamp recess and is 44 feet above the floor. The energy consumption is only 0.75 watt per square foot.

A view in the machine shop of the Benjamin Electric Manufacturing Company is shown in Fig. 11. This room is lighted with 75-watt Mazda C lamps in shallow-bowl type enameled-steel reflectors. The units are on 8-foot centers throughout the room and are 9 feet above the floor. No drop cords or local lighting is used anywhere in the shop, which has a very uniform illumination free from sharp shadows. The workmen are well pleased with the lighting and the ease with which small objects may be discerned; they have been fully converted to overhead general lighting. Fig. 12 shows a view in the plumbing-goods machine shop of the Federal-Huber Company, Chicago. All the lighting is from overhead with 100-watt Mazda C lamps in deep-bowl enameled-steel reflectors.

Editorial Comment

Urgent Need for Improved Lighting of Industrial Plants

DEVELOPMENT of the war is gradually bringing home to the country the full significance of warfare under modern conditions. Not only does it call for millions of able-bodied men, but enormous stores of the most varied and highly intricate supplies. The expanding Navy requires large numbers of vessels ranging from submarine chasers to superdreadnaughts, with their great variety of equipment and sundry supplies for the men. The rapidly increasing Army needs vast quantities of rifles, guns, ammunition, airplanes, motor trucks, ambulances and hospital supplies, besides clothing, food, housing equipment and miscellaneous material. It has been estimated that to keep an army of one million men at the front requires that it be furnished during a year with much over a hundred million tons of all kinds of equipment and supplies.

We are determined to send to the front within another year several millions of as well equipped fighting men as have yet joined in the gigantic conflict overseas. These must all be kept supplied from this country with food, clothing and munitions. The problem involved in the prompt production and shipment of all this huge aggregate of supplies is almost staggering, but it is being attacked heroically and even with considerable success, considering the time and difficulties required to reorganize the vast industrial system of the country from a peace to a war basis.

Much progress has been made in this line since we entered the war. At that time there were a relatively small number of industrial plants making munitions, chiefly for our Allies and only to a very limited extent for our Government. All these are now supplying our own needs and to them have been added several thousand other plants, so that there are now in American factories some millions of men busily engaged in Government work. But this is only a beginning to what will be required in the way of manufacturing facilities to supply the rapidly increasing needs of the Army and Navy. In all probability many other thousands of factories will be compelled as a patriotic duty to adapt themselves to turn out munitions and other supplies, in the same way as has been done on such a large scale in Great Britain and France.

To meet the emergency this product must be turned out as speedily as possible, which means night and day work. It must be turned out perfectly because defective or inferior material is worse than worthless in a crisis like this. It must also be turned out by an augmented force of rather unskilled men and women to make up for the men that have joined the colors or gone to work in shipyards. All these conditions either absolutely require or are definitely relieved by well-lighted shops in which production can go on unhampered by the time of day or state of weather.

Thus we see that the national crisis has made of improved factory lighting a most timely subject. Factory managements must prepare for aiding the Government to the greatest possible extent and as quickly as possible, and one of the first things to be looked after before a Government contract is accepted is to rehabilitate the lighting along modern, efficient lines.

It is to help arouse factory owners to the urgency of this matter that the ELECTRICAL REVIEW has arranged to publish a series of twelve articles on improved factory lighting in the principal industries. The first of these articles, dealing with machine-shop lighting, appears in this issue. The object aimed at is not primarily to furnish new technical data on just what constitutes the best practice in this field now, which important phase of the subject is reviewed, however, but to present to electrical contractors, lighting companies, lighting-equipment salesmen, and electricians of large industrial plants timely information that may with profit be brought to the attention of the factory owner or manager so as to make him see the need of early action on this matter.

The factory owner is apt to feel that lighting that seemingly has been good enough for many years, is amply satisfactory now. He forgets, however, that state industrial commissions are taking an active interest in factory lighting so as to minimize accidents and damage to eyesight. He also does not realize how important a factor improved lighting is in increasing the quality and quantity of factory products, and how low is its cost. Furthermore, the progress of the lighting art is so rapid that systems installed over five or so years ago are now practically obsolete and it will pay to replace them so as to get the benefit of the higher efficiency of modern equipment in greatly improved lighting. The cost of rehabilitating the lighting is so small in comparison with the increased output alone that every effort should be made by electrical men to drive the matter home right now when conditions are favorable to making the changes properly.

The Drive for Saving Coal

NEXT week, June 3 to 8, is to be "Coal Week." During this period considerable publicity is to be given matters pertaining to saving of coal by using it more sensibly. By means of the daily press, the moving-picture theaters, society meetings and demonstrations, instruction is to be given the public and engineers in general on the burning of coal. It is ex-

pected good results will follow. The field is a fertile one for work of this sort, for the number of coal users that can be reached in this way is very large. And the coal they could save, but now waste, is also very large.

The theory that the firemen and engineers are to blame for plant conditions and performance is a convenient but not altogether sound one. The owner of the plant is usually most to blame. Interest, business methods in a business undertaking, and efficiency must come from above, not from below. As often as not the management knows little, and cares as much, about the boiler room equipment and the results it is rendering.

While most boiler rooms have always seemed to be less efficiently operated than they might, the change of coal and use of some grade of fuel in plants designed for some other grade of fuel has tended to lower instead of improve plant performance. The change of coal has been looked upon as temporary and something to be tolerated until better conditions reverted. It would be wiser, and far more desirable, to adapt the boiler rooms to the coals now being used, for it is probable, and to be hoped, that the old prebellum custom of hauling coal from the distance and leaving unused coals nearest the point of consumption with the resultant waste of transportation facilities, of time and labor, is a thing of the past. Now is the time to adapt plants to the new conditions, abandoning old-time methods and men and apparatus that have outgrown their usefulness. Conditions will not be the same again after the war is won.

It must be borne in mind, however, that it is not during only one week but during the 52 weeks of the year, and every year, that attention must be given to burning coal efficiently if coal is to be conserved, and the coal situation to be relieved. And it is during the next 16 weeks or so more particularly so far as concerns perhaps the majority of plants that plant improvement can best be made in readiness for the coming winter with its heavier loads, higher load factors, greater coal consumption and greater opportunity therefore to save coal and reduce the coal bill. The aim of every coal user should be to obtain more heat from a given weight of coal, lose less and utilize more.

Giving the Lineman a Square Deal

NOTWITHSTANDING safety policies, improvements in line construction and operating methods, the work of the lineman remains a hazardous one. Standards of service, continuity of energy supply and uniformity of voltage, increased current-carrying capacity and higher voltage of circuits, and greater capacity behind them are all tending to increase the dangers of linework rather than reduce them.

As the hazards of linework increased, methods of combating them appeared. Many of the larger companies have long since inaugurated instruction classes for their linemen, it being necessary for them to pass an examination before being allowed to go to work on a pole. There are schools that give instruction in linework, one of which was described in these columns not long ago. It is now the common practice for companies to not only furnish their linemen with rubber gloves, belts, climbing irons, shields and mats and other necessary paraphernalia for safeguarding them against the dangers of their calling, but to maintain them in proper condition. In this work the N. E. L. A., various company safety bureaus, and the Bureau of Standards have done noble work.

The war has taken many linemen away from their work, leaving behind the older men and younger, less skilled workers to replace them. It has been apparent for several years that the type of man that once took up linework is seeking employment elsewhere. The ambitious man, alive to the risks and capable of the work, is taking up other forms of work where the opportunity for advancement appears greater and the rate of remuneration is higher. Unless the central-station companies take steps to foster and encourage linework, by making the work more worth while, a few years may see difficulties arising in finding men that can protect themselves and service.

The shortage of linemen, occasioned by the war but enhanced because men are not taking to linework as once they did, makes the problem of finding men to do linework without endangering themselves a most difficult one. It is true that the best safety device is a careful man. But this is not enough. The best safety devices are not too good, for a life is at stake, and the practices of companies in protecting their men shows that the more progressive the company the greater care it takes. Safeguards that once were looked upon as unusual, and acts of magnanimity on part of an employer, are today considered as necessities, omission to take which places legal responsibility and liability upon the employer. It has been established in our laws that "electric companies are bound to use the highest degree of care practicable to avoid injury to every one who may be in lawful proximity to their wires," . . . that it is the duty of such companies to know what safety appliances are suitable and in common and ordinary use, furthermore that an employer that fails to avail himself of existing safety devices assumes the risks of the situation.

The day is disappearing when a corporation had no soul. The day has almost gone when men in all industries opposed safety methods and appliances. One of the most surprising and pleasing facts today is the rate with which the safety doctrine has spread and the manner in which employer and employe have gone wholeheartedly and together into the cause of safety. Meanwhile the war and the times are making it increasingly difficult to maintain the line gangs at full force and top efficiency. Accidents are increasing, as they always do when new men tackle new work. A careful man is the best safety device. But nothing can be too safe, remember. Are conditions made as safe as it is possible for them to be made? That is the question. Are the linemen being given a square deal?

Week's Events

Doherty Managers Meet—New York Society Honors Secretary Guy—Analytical Report of Chicago Telephone Company

DOHERTY MANAGERS HOLD WAR CONVENTION.

Discuss Problems Connected With Public Utility Operation in War Times.

The perplexing problems connected with the operation of public utilities at the present time were discussed at length by the managers of the Doherty properties on May 16-17, following the celebration of Henry L. Doherty's forty-eight birthday, at the Grand Central Palace, New York City.

The sessions, presided over by Milan R. Bump, chief engineer, naturally were more for an interchange of experiences, rather than an attempt to lay down any hard or fast rules for public utility operation in the second year of the United States' entrance into war. Frank W. Frueauff, in complimenting the managers on their handling of the last 12 months' problems, reminded them that far greater ones lay before them in the next few years.

The most important and the fullest discussions were on the questions of adequate rates and labor. The recital of various rate increases allowed Doherty properties, it is felt, will serve as a further inspiration to the managers to strive for further reforms along this line.

Mr. Doherty spoke particularly on this subject and told the managers they "had no reason to feel squeamish about asking for rate increases that would be adequate to pay their men the salaries demanded by the times, as well as the increased costs of operation." He advised pushing the readiness-to-serve rate whenever possible.

"Moreover, we must get rid of candlepower standards for gas, which are a perfect absurdity," he continued. "Gas should never be used for illumination except with mantle lamps. As only about 1 cubic foot in every 1000 cubic feet manufactured is used in open tip burners, it is unreasonable to demand that we enrich all gas for a candlepower standard."

Holton H. Scott, general manager of operations, asserted that public utilities had a brighter future than ever because of the extensive work done in educating the public and officials as to rates and costs. It was also the time, he said, to work for the elimination of unfair ordinances and the securing of new franchises.

Finance was, naturally, an engrossing topic, and the use of trade acceptances was urged by L. R. Musil, treasurer of Cities Service Company. A number of the managers testified to having used these acceptances with success.

"From a patriotic point of view the question of trade acceptances is certainly desirable," said Mr. Musil. "This system has been utilized by the Federal Reserve Banks to open up the use of credit to a much larger number of persons as well as those familiar with the system. Flexibility of currency is certainly desirable at this time, and anything that opens possibilities to us also means aid to our Government.'

GET-TOGETHER MEETING OF ELECTRICAL JOBBERS AND CONTRACTORS AND DEALERS.

Co-operation, Publicity and Uniform Goal Features of Meeting.

As already mentioned in the ELECTRICAL REVIEW, the Electrical Supply Jobbers Association and a committee of the National Association of Electrical Contractors and Dealers, met at Hot Springs, Va., during May 21 to 23. A portion of the business transacted during the earlier period of the meeting has already been mentioned in these columns.

The attitude being taken toward the middlemen or jobbers came up for considerable comment and discussion. The agitation against jobbers is taking definite form, and this has if anything been somewhat encouraged since the Government has advocated short-circuiting them in some instances. It has been felt that the position and function of the jobbers is not fully understood nor appreciated. The jobber fulfills an important purpose, acting in degree as banker, as go-between between consumer and producer for maintaining stocks of supplies on hand and shortening time of deliveries. The electrical contractors seem to understand this fully, but dealer, consumer and manufacturer have yet to fully understand the important function of the jobber. A. M. Little, Syracuse, and many others strongly advocated the appointment of a publicity or advertising committee. General-secretary Oberbagh was authorized by unanimous vote to appoint a committee of three to constitute a publicity committee. This committee is already in the making. An appropriation for carrying on the work was also ordered to be made.

A general survey of conditions in the electrical industry showed that while building operations are practically stagnant activity in the industrial field more than makes up for the loss due the former cause. Moreover, Government work has increased trade very materially in many places. It is now most apparent that the demand for luxuries and apparatus classed as such is decreasing, while the demand for labor and time-saving apparatus is on the increase for both industrial and domestic purposes. The sum total of opinion was that the jobbers are doing well under existing circumstances, and there is no need for alarm. From Canada came the report that conditions there are not good, nor the outlook bright. Since the contracts for war munitions awarded in the early part of the war have been largely completed, the prosperity due them has largely subsided. Accounts are difficult to collect, and the market and prices are unsettled.

The meeting of the central division, held Tuesday morning brought out some interesting facts as emphasizing the effect of wage and salary increases, higher costs of materials and freight charges, increased taxation and other allied demands, upon the cost of doing business. A number of jobbers reported that

their payrolls had increased in some cases 15 to 20 per cent during the last year, making a total increase of 25 per cent since 1916. The excess profits tax also has had its effect, being in some cases 55 per cent of their net profits, but averaging about 23 per cent. It seemed to be the general experience that while the volume of business has decreased the cost of doing business has increased.

One fact brought out was that the trade acceptance requires wider adoption than it has as yet received. The universal adoption of the trade acceptance is to be greatly desired, because without it its use in the jobbing trade may possess a number of disadvantages.

As stated in last week's issue of the ELECTRICAL REVIEW, the jobbers raised $1500 for the Red Cross on Wednesday evening by auctioning off a dozen golf balls that had been donated by the U. S. Rubber Company through A. P. Eckert of the insulated wire department of that company. The next day, Thursday, when this money was turned over by F. M. Bernardin to the Red Cross the electrical manufacturers present raised a similar amount. This good work was engineered by W. E. Robertson of Buffalo, N. Y., for the jobbers, and was led by A. L. Eustice of Chicago, for the manufacturers. In addition the Jobbers Association donated $2000, resulting in over $5000 being paid to the Red Cross by the electrical men present at the Hot Springs jobbers' convention.

The convention proved an immense success, because of the large number of forceful speakers and the interesting and important character of what they had to say. It is expected that future meetings will be open to the electrical people in general. That this be the case was strongly favored by E. W. Rockafellow of New York, and D. E. Harris of San Francisco and many others.

The members of the Electrical Supply Jobbers Association in attendance were:—

W. F. Abely, W. L. Adams, F. M. Bernardin, W. I. Bickford, F. Bissell, W. S. Bissell, T. H. Brindley, C. E. Browne, W. A. Browne, G. D. Cabaniss, W. S. Clark, A. J. Cole, T. J. Creaghead, W. A. Dalrymple, A. S. De Veau, W. J. Drury, F. R. Elliott, H. Q. Foreman, F. L. Funsten, L. V. Garron, H. N. Goodell, H. J. Gorke, E. C. Graham, F. W. Greusel, A. L. Hallstrom, F. S. Hardy, D. E. Harris, N. G. Harvey, W. R. Herstein, G. B. Hill, C. C. Hillis, W. P. Hoagland, H. T. Hochhausen, E. N. Hyde, J. G. Johannesen, E. A. Jones, G. R. Jones, F. J. Judd, Jr., H. Larson, L. M. Levine, A. W. Lindgren, C. J. Litscher, A. M. Little, A. R. Loughborough, W. W. Low, W. S. P. Mayo, G. T. Marchmont, C. T. McKinstry, A. Miller, N. H. Miller, L. T. Milnor, J. O. Morris, F. Oberbagh, M. A. Oberlander, R. P. Oblinger, J. L. Owen, J. A. Pizzini, J. R. Powers, F. S. Price, G. W. Provost, J. L. Ray, J. Richardson, W. E. Robertson, E. W. Rockafellow, O. F. Rost, W. H. Rush, H. I. Sackett, J. C. Schmidtbauer, G. A. Seabury, A. J. Selzer, G. W. Shimp, H. O. Smith, S. Sprague, C. J. Stahl, F E. Stow, J. B. Terry, A. F. Thatcher, H. F. Thomas, F. D. Van Winkle, W. T. Walker, G. M. Warner, V. C. B. Wetmore, C. D. Williams, H. R. Worthington.

SERIES TRANSFORMERS FOR STREET LIGHTING ARE SUCCESSFUL IN MILWAUKEE.

Paper Presented by F. A. Vaughn Before Meeting of Electrical Engineers in Chicago.

At a joint meeting held on May 27 by the Chicago Sections of the American Institute of Electrical Engineers and Illuminating Engineering Society, and the Electrical Section of the Western Society of Engineers, F. A. Vaughn presented a paper entitled "Regulation of Street Series Lamps in Practice." Mr. Vaughn described particularly the use of series-multiple transformers in the new street-lighting system of Milwaukee, which he and his colleagues designed. This system was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of April 1 and 8, 1916. One of the unique features of this system is that the street-lighting circuits are series, constant-current circuits, fed from 2300-volt, 60-cycle, constant-potential circuits, the lamps being connected to the series circuit through special transformers buried at the base of the pole. These transformers are made in five sizes, three for 6.6 and two for 20-ampere lamps. They are so designed as to give almost ideal regulation for the lamps, the series circuit giving substantially constant current regardless of the number of lamps that may be out of commission. The use of these transformers has dispensed entirely with the need of ordinary constant-current regulating transformers that are usually supplied at the substation. Recording voltmeters and ammeters installed at the substations have shown exceptionally good regulation for this system. No trouble has been experienced with the transformers, which are inclosed in a steel case protected by an outer casing of either wood, fiber or earthenware filled with insulating compound. The regulation has been so satisfactory that the lamp life has been materially increased, the average life of the lamps proving to be about 2500 hours.

In discussing the subject, Preston S. Millar praised Mr. Vaughn for this daring departure from regular practice. Incidentally, he mentioned some of the war activities of the Illuminating Engineering Society.

NEW YORK ELECTRICAL SOCIETY HONORS SECRETARY GUY.

Resolutions Passed on Nomination for Thirtieth Consecutive Year.

A remarkable story of construction efficiency was told by V. T. Goggin at the meeting of the New York Electrical Society on May 23. The subject was "The Construction of Camp Devens."

Mr. Goggin related how in a few weeks a stretch of 2000 acres of scrub oak and pine land was transformed into a cantonment with complete water, sewer and lighting systems, and building accommodation for 40,000 soldiers. The subject was illustrated with lantern slides and moving pictures.

An address on Red Cross work at home and abroad was given by Major D. L. Redman.

A testimonial and a life membership in the Society were presented to George H. Guy in celebration of his 30 years' service as secretary of the Society.

The following resolution, passed by the Nominating Committee, was read:

"At a meeting of the Committee for the Nomination of Officers for the New York Electrical Society for the coming year, held May 8, 1918, George H. Guy was nominated for secretary for the thirty-first consecutive annual term, whereupon the following special resolution was unanimously adopted:

"Whereas, the Nominating Committee, in placing the name of George H. Guy before the New York Electrical Society as candidate for the office of secretary recognizes that this constitutes Mr. Guy's thirtieth consecutive annual renomination to an office, which he has, to the enhancement of the tradition, the welfare and the prestige of the Society so long filled; and

"Whereas, the Committee desires to take notice of the occasion and to make some expression of appreciation and affection for Mr. Guy, now, therefore, be it unanimously

"Resolved, that we, the Nominating Committee, on

the occasion of his completing 30 years of devoted service to the Society that appointed us, do hereby and sincerely and gratefully extend to Mr. Guy our affectionate greetings and congratulations upon his long and faithful service, and our best wishes for the continuation of that service, and for his good health, his happiness and his prosperity."

The following resolution was adopted by the Society:

"Whereas, the Society, at its 365th meeting, has heard with pleasure the resolution in regard to the secretary, Mr. George H. Guy, adopted by the Nominating Committee, it is hereby

"Resolved, that the Society as a whole endorses all the sentiments of esteem, appreciation and good will that it expresses, and adding its own utterances of affection and gratitude for long continued service given with disinterested devotion, expresses its desire that the secretary be presented with a life membership in the Society."

The Nominating Committee was composed of Putnam A. Bates, Elmer A. Sperry, Gano Dunn, Fred A. Scheffler, H. H. Barnes, Jr., E. B. Katte, G. H. Barbour and Frank J. Sprague.

CHICAGO TELEPHONE COMPANY MAKES ANALYTICAL REPORT OF SERVICE AND REVENUES.

Need for Increased Revenue Shown by Statement of President Sunny Before City Council.

The Chicago Telephone Company, under date of May 8, submitted a report to the Gas, Oil and Electric Light Committee of the city of Chicago, dealing with the classification of services and rates therefor for the five-year period ending May 26, 1918, such classification and rates having been fixed by ordinance passed May 26, 1913. The report exhibits the activities of the company during that period, a summary of which is as follows:

Conditions at the close of 1912, and at close of 1917, with differences given in percentages, are thus shown:

Year ending December 31.	1912.	1917.	Per cent increase.
Average plant	$31,559,815	$56,136,789	78
Gross earnings	12,045,273	19,003,801	58
Net earnings	2,590,526	2,911,085	12
Dividends and interest paid	2,308,722	2,931,936	27
Average number telephones	285,578	475,022	66
Average number of employes	8,811	12,401	41
Pay roll (operating and construction)	5,857,440	10,130,868	73

The next table summarizes revenues, expenses and annual surplus after payment of all charges. The satisfactory showing for the four years of 1913 to 1916, inclusive, was by reason of higher efficiency and increased gross earnings, in the face of the material reductions made in rates in 1913. The results for the first half of 1917 were likewise satisfactory, but from that date on the service felt the adverse effect of war conditions. In the spring of 1917 the bonus paid employes amounted to $465,000, drawn from the surplus of the preceding four years. The surplus for the last half of that year was wiped out by increased salaries and higher cost of material, which also created a deficit of $400,000. The summary is as follows:

	Gross revenue.	Expenses (including interest and dividends).	Balance annual surplus.
1913	$13,542,473	$13,121,239	$ 421,234
1914	14,454,914	14,093,832	361,082
1915	15,567,748	14,839,785	727,963
1916	17,373,767	16,360,978	1,012,789
1917 (first half)	9,540,234	9,163,880	376,354
1917 (last half)	9,463,567	9,860,772	—397,205
1917	19,003,801	19,024,652	—20,851

The falling off of revenue for the last half of 1917 is continuing through 1918. An increase of 10 per cent on operators' wages, to help them meet the increased costs of living, was recently made, amounting to an annual increase of $450,000, and other payroll changes to go into effect soon will amount to an additional $800,000.

It is pointed out that the deficit for 1918 would reach $800,000 by operating on the basis of 1917 expenses. When payroll increases of 1918 are added this deficit must reach $2,050,000, which will be further augmented by greater costs of material. The company requires a revenue that will amount to $2,500,000 more per annum than at present.

The three methods by which the situation might be met are as follows:

First, the gross revenue of $19,003,801 includes exchange and toll. The exchange revenue is $17,438,680. A horizontal increase of 14 per cent of all exchange rates will produce about $2,450,000, but such horizontal increase would be burdensome and unfair to many subscribers.

Second, the ordinance of 1907 continued the practice of supplying service at flat rates in the Chicago exchange against the judgment of the city's experts and the telephone company. Testimony was produced from various parts of the country that the flat rate service plan was discriminatory, obsolete and should not be permitted to continue in any metropolitan exchange.

Under the 1913 ordinance we are supplying service at flat rates on 1600 lines in the premises of large users, at a charge of $1 per day per line, while the cost thereof, according to the city's experts, considering the higher costs for labor and material at this time, is actually more than double the revenue derived therefrom.

We are supplying 8282 lines with unlimited service at $125 a year, at a loss of from $25 on some lines to perhaps $400 on others, on account of the volume of traffic carried.

We are supplying 9100 single line flat rate telephones for residences and 5100 two-part flat rate residence telephones at $72 and at $56, respectively, per annum, both at a heavy loss, because of the excessive number of calls.

We have about 13,000 so-called "neighborhood" telephones, business and residence, in the outlying districts operating on a flat-rate basis and at heavy loss.

A summary of the flat-rate services shows that 54,146 telephones in that class, or 11 per cent of the total, produce 17 per cent of the gross revenue but create 35 per cent of the calls.

The third plan is that, inasmuch as the deficit is largely due to the presence of the flat rates in the schedule, if the company is compelled to continue supplying that class of service, the flat rate customers should wholly stand the burden of any increase in rates. To accomplish this it will be necessary to increase these rates 75 per cent.

There are 487,481 telephones in the exchange, of which more than half, 248,835, are the so-called "nickel a day" ($18.25 a year guarantee). These telephones are used by subscribers of moderate means, and they undoubtedly cover the most extensive, best and cheapest telephone service in the world. The company should not be required to furnish private branch exchange switchboards free of charge, which has led to an abnormal demand for appliances of the kind and which are supplied at the expense of subscribers using less elaborate equipment.

SEATTLE PLANS BUILDING NEW HYDRO-ELECTRIC PLANT.

New 35,000-Kilowatt Station to Be Constructed on Skagit River.

The city council of Seattle has decided to call for bids for the construction and equipment of a hydro-electric power plant, on Skagit River, of 35,000 kilowatts capacity, to meet increasing power and lighting demands in the city. In relation to these contemplated improvements, A. H. Dimock, city engineer, has issued a statement, from which the following is taken:

The permanent and durable character of construction contemplated requires concrete dams, rock tunnels, concrete powerhouse, the best grade of machinery, and steel towers for transmission lines, with appliances and accessories of like character.

The site of the proposed power plant is on the left bank of the river, at a point 16 miles up-stream from Marblemount, which is 10 miles from Rockport, the latter being the terminus of a branch of the Great Northern railway. Thus, all material will have to be hauled from Rockport to the dam and power sites, a distance of 26 miles. The plans require the building of six miles of new road at the upper end of the route. The location selected is about 100 miles northeasterly from Seattle, and the transmission line will have to be about that length.

The dam site is 2½ miles up the river from the powerhouse site. The water-storage provided by the dam will be sufficient to utilize the volume required to meet the demands for power. The height of the dam will materially increase the available head at the plant.

The amount of power developed depends upon the volume of flow and the head available. The Government record for 9 years showed the lowest flow in those years as follows, the figures being the average number of cubic feet per second for a period of five days:

1909	1,350 cubic feet flow per second
1910	1,530 cubic feet flow per second
1911	910 cubic feet flow per second
1912	972 cubic feet flow per second
1913	880 cubic feet flow per second
1914	1,110 cubic feet flow per second
1915	755 cubic feet flow per second
1916	935 cubic feet flow per second
1917	843 cubic feet flow per second

Every cubic foot per second of water passing the dam will develop a continuous output of 27½ horsepower delivered in Seattle, the net effective head at power houses being 330 feet. The demand for power, however, is not continuous, the maximum demand being approximately twice the average demand. The amount of machinery installed in a power plant, under present conditions, should be sufficient to develop twice the output of continuous or average power. The construction of the dam will permit the storage of water during the day so that there will be sufficient to furnish this maximum demand at any time. Every cubic foot per second of flow will, therefore, justify the installation of water-wheels and generators capable of delivering twice 27½ or 55 horsepower in Seattle. A plant capable of delivering 50,000 horsepower in Seattle will require an average flow of 909 cubic feet per second. It will be seen by reference to the table that in 1915 the average flow for the five-day period was 755 cubic feet per second. The year 1915 was the dryest in the history of Western Washington and was the year of lowest flow in our streams. This shows a shortage for this period of 8740 horsepower. When this plant is constructed, however, the steam plant built by the city on Lake Union will be available as a stand-by plant to be used in case of accident in the hydroelectric plants, and also to supply peak load demands or a shortage of power occasioned by low water or from any other cause whatever.

The dam is to be of solid masonry, founded upon solid rock. It will have a length of 400 feet, and will raise the water 100 feet. A tunnel 11,000 feet long, to be cut through solid granite, will be required to conduct the water from the dam to a point above the power plant, where there will be a fall of 330 feet.

The estimated cost of the plant, and a 103-mile transmission line, carried by steel towers, is $5,000,000.

OREGON COMMISSION REFUSES TO RESTRAIN COMPETING COMPANY.

Holds That Jurisdiction Does Not Apply in Case of Two Companies Supplying Klamath Falls, Ore.

An important case involving the interests of two competing public utility companies operating in Oregon was decided by the Public Service Commission of that state on May 2.

The complainant was the California-Oregon Power Company, which supplies electric energy for light, heat and power in several counties of Southern Oregon. Especially has it served the city of Klamath Falls and contiguous territory for a number of years as the only utility company occupying that field.

The defendant is the Keno Power Company, which operates a hydroelectric plant on Klamath River, 12 miles south of the city of Klamath Falls. Energy from this plant, where 850 horsepower has been developed, is distributed to various customers.

Early in 1917 the defendant company was granted a franchise to sell and distribute electric light and power service in the city of Klamath Falls, and thereupon proceeded to extend its transmission lines to a substation point within the limits of that city, to become an active competitor of the California-Oregon Power Company.

The complainant company appealed to the Public Service Commission, asking that the defendant company be restrained from the further extension of its lines into Klamath Falls, and asking the Commission further to declare that neither the present nor future public convenience or necessity require or will require the construction of the defendant's lines.

The defendant had not applied for a certificate of public convenience from the Public Service Commission, taking the position that the provision in the Oregon laws of 1917, requiring such certificates before entering an already occupied territory, did not apply in this instance, because the work of extending its lines into Klamath Falls had begun before the said law became effective.

The Commission declined to issue the restraining order asked for on the ground that the provisions cited by the plaintiff did not apply to proceedings of this nature between two utility companies, but had reference to independent investigations; and on the further ground that the Oregon law granted no explicit nor implied authority to the Commission to issue such restraining order. The Commission also declined to declare that "neither the present nor future public convenience or necessity require or will require the construction by the defendant of the transmission lines under consideration." The Commission maintains that it can pass upon the latter question only in case an application is made by a utility company desiring to invade a new field.

Commercial

Newspaper Upholds Utilities—Electric Trucks Economical for Coal Delivery—Electric Brass Furnace Perfected

REACHING THE PUBLIC THROUGH NEWSPAPERS.

Indianapolis Daily Takes Side of Utilities in Advocating Increased Rates and Fair Dealing on Part of Public.

From the Merchants Light & Heat Company of Indianapolis, Ind., we have received the appended article which appeared in a recent issue of the Indianapolis *Star,* and which points out the necessity of granting public utility companies increased rates. Needless to say, the attitude taken by the press is somewhat unusual but can be attributed to the friendly relations which the utility company has established with the press and with the public.

Probably nowhere else in the whole field of commodities of general use has there been as small an increase in prices to the consuming public as in public utilities. That this is so is due in large part, of course, to the fact that the prices of utilities, most of the time, are subject to local or state regulation, practically immovable either because of local contracts or franchises, or because a state board's powers are complete and absolute. There is a fundamental reason for this regulation. It is founded on sound economics, generally so accepted both by leaders of political thought and public administration, and by financiers and managers of utilities.

But there is a phase of this regulation that must not be overlooked. It can operate, in a period of rising commodity values, to the disadvantage. if not to the complete destruction, of many utilities. That is precisely the condition that confronts the majority of the utility companies in the country today. It is a condition that is recognized generally by state regulatory bodies and in some instances by cities.

The costs of production of the commodities sold by public utilities have increased—doubled in many cases, trebled in others. Still, if the separate utilities are not to have the advantage of increased returns, either one of two results is inevitable. The utility must draw upon its surplus and capital account to continue operation, or it must face something approaching bankruptcy.

Why Public Is Indifferent.

The fact that there is something intangible and at times invisible about the character of most utility service operates against any immediate public realization of the difficulties that beset the companies.

In a condition when sugar or flour is scarce the fact becomes so well known that the public reconciles itself to the increase in costs. But the public generally takes no account either of the magnitude or the volume of costs involved in public service.

Take the street car companies, for example, or the light or gas companies, or a telephone or water company.

The individual's only conception of the service or the magnitude of these corporations comes, in the usual run of cases, in his contacts with them. He does not visualize sufficiently the enormous costs that enter into the operation of 250 or 300 street cars each day. He has scant conception of the amount of coal that is needed to drive turbines to supply electric power. He is not informed as to the costs of labor or the amount and variety of labor required at power houses and on car lines.

The same lack of knowledge is apparent in any of the other cases. The average consumer's contact with a telephone company is limited to his use of his own telephone, and he is more concerned with the rapidity and perfection of service than with the problems of a central company laboring under shortage of labor and soaring prices of materials that are indispensable for the upkeep and extension of lines.

And there is, behind this failure of the consumer to visualize the magnitude of the utility corporation, a fixed antipathy to utility corporations—an antipathy justified in part by the past attitude of these corporations toward the public, but certainly not justifiable now in all cases. Added, then, to the prevailing indifference of the public, in the large majority of instances, is the feeling that if the utilities are pinched now, they are getting exactly what they deserve for past sins.

Whole Community Affected.

But there is a broader view, a fair-minded view, that certainly will actuate most persons when they know all the facts. There is, also, an important, a very vital, public consideration wrapped up in this question of increased costs of operation of utility plants. If these plants are not relieved by an increase of rates, and their income remains stationary while their expenditures keep pace with the general mounting costs of the whole country, they face bankruptcy or impaired plant and equipment.

If the companies fail, through lack of public and regulatory support, to get the necessary increases of rates, they may continue operation, but their plants become progressively worse, because depreciation goes on and no repairs or renewals can be made. And, if the plants become inefficient, what happens? The utility itself is the primary sufferer, of course; its financial standing is injured and its physical equipment may become little more than junk.

But the community, through a short-sighted policy of withholding necessary relief, suffers much more. Every city is as much dependent now on utility service as the human body is upon blood. Street cars, electric light and power, gas for domestic and industrial uses, telephone service and water are indispensable in the present organization of community and industrial life. Crippled or impaired street car service, for example, might mean more loss, in a few months, to the industrial section of any large city than the entire amount of the increase in utility rates. Workmen would become dissatisfied and would leave the plants served by the inefficient lines, or, through being late at work, might curtail the efficiency of the factories.

Now, of all times, the United States is dependent on utilities. Electricity is the cheap and convenient power for manufacturing purposes. Great central-station plants, like those in Indianapolis, have been erected especially for the industrial use of electricity. The manufacturers of war supplies, driving their organizations at top speed, want all the power they can get. They want to guard against breakdowns. They want perfect service. They are entitled to it. But they recognize also, in the main, that every laborer is worthy of his hire, the utility no less than the munitions manufacturer.

How Costs Have Increased.

There has been a perceptible change of public opinion recently toward the requests of utility companies for higher rates for the duration of the war, or for such period as prices of all commodities are on their present level. States and municipalities are investigating the demands for increased rates and generally are allowing advances.

And why shouldn't increases be permitted, when the increased costs of utility operation run from 100 to 200 per cent? Take a recent official statement of an Indiana utility. The price of its coal at the mine advanced 138 per cent; freight, 23 per cent; fire brick, 233 per cent; copper wires, 166 per cent; poles, 148 per cent; engine oil, 100 per cent; pipes and repair fittings, 98 per cent; horse feed, 110 per cent; tools and equipment, 75 per cent. Even the taxes of the corporation have been advanced 110 per cent in two years.

In most business lines, such is the operation of economic laws, a general advance in cost of materials and operations calls for a corresponding advance in the price for which the manufacturer or merchant disposes of his wares. But the fixed rate of the utility suspends the operation of economic laws in its favor. The situation now developed argues for an increase in rates for the high-price period. With a return of normal conditions there must come, of course, a return of the former rates.

ELECTRIC VEHICLE ECONOMICAL FOR COAL DELIVERY.

Boston Edison Company Co-operates With User to Insure Satisfactory Operation.

There are 35 or more electric trucks employed in the coal delivery trade in Boston. Some of these trucks are over six years old and are still doing their work with no sign of distress. During the last winter of severe weather and unprecedented demands for coal these trucks acquitted themselves admirably. Where the horse was unable to venture, the electric truck went, and overloaded. Where the gasoline truck broke down, could not be started because of the cold, or became unreliable because of the heavy loads, the long hours and want of overhauling, the electric truck delivered coal and kept on delivering coal often 20 hours a day.

The Edison Electric Illuminating Company of Boston has a garage and battery service system already well founded by which a truck owner is able to exchange a battery in need of re-charge for one fully charged. Moreover, arrangements are such that the exchange may be made with only a short loss of time. One fleet of six trucks employed delivering coal is operated in this way, and during last winter, when the demand for coal was unprecedented, these trucks worked almost night and day making deliveries, batteries being changed as required.

Great emphasis has been laid upon operating costs of various methods of coal delivery. Operating costs are important, but there are other phases of the matter that are also of considerable importance. The demand for coal is variable, and the facilities to supply it must be capable of varying with the demand and yet not represent an uneconomical investment during the times of low demand. The horse must be fed whether it works or not. It cannot be forced to any extent, and at best for only a short time. For humane reasons the horse cannot be treated as a machine, as regards intensity or duration of work and conditions of weather. Comparison between mechanical propulsion, that is, between the gasoline and electric trucks, apart from cost, embraces reliability, frequency of inspection, need for repairs and replacements. The gasoline engine and transmission mechanism, with its many moving parts and high speeds, suffers with long hours of work and at best has small margin of overload. And even so, the maintenance required increases rapidly, while deterioration occurs, and shortened life. During busy seasons maintenance is usually neglected, and thus a gasoline truck suffers breakdowns, high operating costs and shortened life. The electric is ideal for uniform sustained service, because of its few and rugged moving parts and its smooth acceleration and running characteristics. Moreover, abuse of the electric by an unskillful or ignorant driver is less deleterious than when the same occurs to a gasoline truck.

Another thing to bear in mind is that, with some exceptions, the cost of energizing the electric has remained stationary whereas the cost of horse feed and gasoline have both soared, and are not yet stable.

Actual cost data are difficult to obtain from the truck user. The average truck user fears to tell the economies of electric trucking because he wants to have a hard-luck story to tell the central station on the one hand and he fears his competitor may imitate him by adopting electric haulage also on the other hand. However, data are collecting as to energy consumption —which is the variable—per ton-mile or car-mile, especially from sources where garage and battery serv-

Fig. 1.—One of Boston's Thirty-five Coal Delivery Electric Trucks.

ice are in vogue. From information from some of these sources it is conservative to claim a reduction of 40 per cent over haulage by gasoline trucks, operating costs thus being about 60 per cent. This is a conservative estimate, and in many instances there is a greater saving. Actual savings are greater, based on present prices, as the above applies to conditions existing before the war.

The electric truck is particularly fitted for coal delivery in down-town districts where streets are narrow, traffic dense and conditions congested generally. The electric truck is so quickly manipulated, turned in so small a space due to its comparatively short wheel-base, and accelerates so rapidly that its use does much to alleviate delays to traffic and the aggravating congestion that so often accompanies the maneuvering of large horse-drawn wagons and gasoline trucks.

In Chicago a number of very large gasoline trucks are employed by some coal dealers for delivering coal to some of the large buildings in the "loop." These trucks with their long wheel-base have caused much unfavorable comment, because while maneuvering for their correct position and while dumping their load they reach out and stop street cars. If these trucks were equipped with batteries and battery boxes installed between the wheels instead of with engines protruding at the front, it would be possible to unload coal without interfering with traffic and making necessary the passage of rules forbidding the delivery of coal except between certain hours of the day.

It is becoming more and more the policy in our cities to adopt centralized heating, supplying the steam and hot water for several buildings from one building equipped with sufficient capacity. While saving coal, this arrangement necessitates the concentration of coal supply within a restricted area, and unless precautions are taken, difficulties soon accrue between the city, traffic police and other parties due to the incessant obstruction of traffic and noise and fumes of gasoline cars. This has been so marked in some cases that coal delivery is only permitted during the night and early morning. The use of electric trucks with their comparatively short wheel-base would do away with the fumes and the noise, and reduce very much if not almost entirely congestion of traffic.

A form of coal delivery, not quite the one here inferred, is coming into rapid use in Great Britain since the war has caused a shortage of coal, labor and horses, and emphasized the absolute necessity of economizing in time as well as money, labor and fuel. Many of the municipal central stations and isolated plants have gladly taken up the electric truck for delivery of coal and removal of ashes and cinders. The plants are often erected away from favorable water and coal supplies, hence, water-cooling towers are used and coal is brought in by truck or wagon. For this class of work, regular haulage upon a definite cycle, the electric truck shows great economy. The trucks make their deliveries of coal during the day and at night are able to remain at the station and be charged up, leaving in the morning with their loads of ashes, returning with coal. For such work, low operating costs are, of course, necessary. But absolute reliability is also essential, and this the electric truck has to far greater degree than the gasoline truck. In fact, electric trucks are working today that over a period of one year and several years are able to show a reliability efficiency exceeding 99.5 per cent, equivalent to working 307 days out of the 365.

There is another phase of electric coal delivery

Fig. 2.—Coal Is Dumped In a Business-Like Manner Without Loss of Time.

that deserves attention. That is the convertible body. Many coal dealers are also dealers in ice. The demand for coal is at its maximum during the winter months when the demand for ice is the lowest. In the hot summer months the demand for coal is low, but the demand for ice is at its highest. The coal and ice dealer possessing electric trucks that may be converted for either ice or coal is able to operate then at a very high load-factor and thus obtain maximum return upon the investment, as well as having to have a minimum investment and at the same time do more business than he otherwise would be able to do. Chicago has 30 such trucks operated by one company alone, many of them repeat orders, delivering ice or coal as the season demands.

NEW YORK COMPANY ASKS FOR RATE INCREASE.

The Queens Borough Gas & Electric Company, which operates in the Far Rockaway Section of Queens County, N. Y., and in the adjacent portions of Nassau County, has filed with the Public Service Commissions for the First and Second Districts, New York, tariff sheets showing proposed advances in the company's maximum rates effective June 1, 1918, as to the territory within the First District, and June 14 as to territory outside the city of New York. It is proposed to advance the rates for electricity from 12 to 15 cents per kilowatt-hour, and the rates for gas from $1.15 to $1.40 per thousand cubic feet.

HOUSE-WIRING CONTINUES IN MINNEAPOLIS AT RATE OF 100 PER WEEK.

During the six weeks ended May 15 old dwellings in Minneapolis were wired and equipped for electricity at the rate of 100 a week. All of these dwellings are located along the existing lines of the Minneapolis General Electric Company, which can reach them, therefore, without investment in extensions. The demand for house-wiring in Minneapolis surprised electrical contractors of that city who were prepared for dull business on account of war time. It has been apparent, however, that many wage earners are exceptionally prosperous and for the first time in a position where in their opinion they can afford to make this improvement in their homes. T. H. Kettle of the sales department of the company says:

"Practically every house that is wired is starting off with at least an electric flatiron and many of them with other appliances as well.

"We had a very good month in April in the sale of appliances both in our own department and also throughout the city. In our own appliance department the sales were 53 per cent over April, 1917. Sales covering the whole city were 40 per cent ahead of April last year. Power users throughout the entire district served are readily agreeing to rate increases in view of the present situation. As to the outlook for the next two or three months, everything points to a continuance of the present activities, both in house-wiring and the sale of devices."

The sales department of the company during the week ended May 17 accepted contracts for 468 electric customers with 325 kilowatts of lighting load and 1963 horsepower in motors. Contracts were taken for wiring 77 already built houses during the week. The net connected load gain for the week includes 64 customers with 101 kilowatts lighting load and 1990 horsepower in motors. The power load includes 1800 horsepower for the City's Northeast water pumping station. Electric energy output for the week was 13 per cent greater than for the corresponding week of last year.

ELECTRIC BRASS FURNACE PERFECTED BY BUREAU OF MINES.

Free Licenses for Its Manufacture Will Be Issued by Bureau—Many Economies Claimed.

The Bureau of Mines has announced the perfection of a type of electric melting furnace that may be revolutionary in the making of brass. Patents on this furnace, known as the Rocking electric furnace, have been taken out by the Bureau and have been assigned to Secretary of the Interior Lane as trustee. Free licenses to operate these furnaces under the patents, it is understood, can be obtained by making application through Van H. Manning, director of the Bureau of Mines.

The new furnace, which it is claimed will reduce the important losses in brass melting, is the result of five years' experimentation by H. W. Gillett, chemist of the Bureau of Mines, in co-operation with the laboratory of Cornell University, the American Institute of Metals and a number of manufacturers of brass.

Up to the present most brass has been made in costly crucibles of imported clay and graphite. Since the war it has been impossible to obtain the imported materials for crucibles, and manufacturers have had to put up with crucibles of much poorer quality, and at a cost many times that of pre-war prices. With the huge tonnage of brass needed for war purposes, such as shells for cartridges, manufacturers have been anxious for a solution of the crucible problem. The Bureau states it is inevitable that the next few years will see electric furnaces largely replacing crucible furnaces and that there will be a development comparable to that seen in the steel industry in the last few years. The electric furnace, it is also declared, will greatly decrease the loss of zinc which, together with copper, makes brass. Zinc boils at a much lower temperature than copper, and there have consequently been large losses in the open crucible furnace through volatilization of the zinc. The electric furnace is closed and these losses are avoided. It is estimated that the unnecessary losses in brass making are more than $3,000,000 a year in normal times and perhaps $10,000,000 a year in war times. Another claim for the electric furnace is that it gives more healthful working conditions for the men.

The Michigan Smelting and Refining Company, Detroit, Mich., already has one of these furnaces in operation and has four more under construction. The C. B. Bohn Foundry Company of Detroit is building two of these furnaces.

UNITED ELECTRIC LIGHT & POWER TO INCREASE CAPACITY.

The United Electric Light & Power Company, of New York City, has recently placed an order with the Westinghouse Electric & Manufacturing Company for a 22,000-kilowatt turbogenerator set. The generator will be rated at 25,000 kilovolt-amperes at 85 per cent power-factor, 8000 volts, three-phase, 62½ cycles. It will be direct-connected to a Westinghouse 22,000-horsepower turbine. The order includes a 40,000-square foot surface condenser and the usual auxiliaries.

Operating

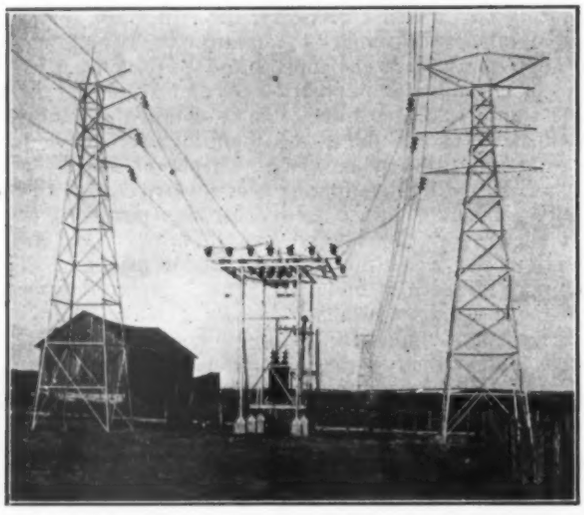
A Two-Circuit Outdoor Substation Supply—Induced Currents in Pipe Framework—Features of Battery Room Design

A TWO-CIRCUIT SUBSTATION TAP.

Interesting Method of Supplying Outdoor Substation from Both Circuits of Two-Circuit Transmission Tower.

The accompanying illustration shows an outdoor substation that employs an interesting method of transmission line construction and at the same time was designed with a view to future possibilities.

This substation supplies a rural community with three-phase energy, obtaining its supply from a 66,000-volt transmission line. To assure as high a degree of continuity of service as possible, and to take precau-



Method of Supplying Outdoor Substation for Double Circuit Transmission Line.

tions against needless interruptions for longer periods than necessary, the substation is seen to be fed from either or both of two transmission lines. The lines are carried by suspension type insulators. Making taps off two circuits thus supported from the same tower is not an easy task because of the large amount of clearance involved, unless either the substation structure covers larger area or additional structures are installed to which the feed-in wires can be anchored.

In the present instance the difficulty was overcome, with a minimum loss of time and material, by installing an additional steel tower. This tower happened to be on hand, a spare. It was installed on the side of the substation opposite from the transmission line, and one circuit was carried from the main tower over to this tower beside the substation, and then after passing the substation, continued on its way to the two-circuit tower again. The circuit on the other side of the tower was strung straight through on the tower that previously carried both circuits but on the inner instead of the outer arms. From both towers leads were taken off to the substation. This arrangement enabled the installation to be made without loss of time and with material on hand. Moreover, it has made a very satisfactory job.

Another feature of this installation which, by the way, is about six years old, is that of mounting the transformer. It can be seen in the illustration that the transformer is mounted upon a truck, which in turn is supported by small runners or wheels. Moreover, the platform of the substation is placed above the ground at a height corresponding to that of the usual wagon. By this arrangement the transformer may be easily moved into the substation from a wagon without any lifting having to be done where it might be inconvenient to do it, and vice versa. Should it be necessary to change the transformer because of accident or for a different size of unit, the operation can be done quickly and cheaply with a minimum of labor.

INDUCED CURRENTS IN PIPE FRAMEWORK.

Method of Calculating Induced Currents from Knowledge of Arrangement of Conductors and Supports.

By A. R. Zahorsky.

In modern power stations it is found convenient to mount the insulators supporting electrical conductors on iron pipe framework where in some cases and under certain conditions certain electromotive forces are induced. That these may be by no means negligible will be shown, also the method of predetermining them by calculation after a knowledge of the arrangement of conductors and framework.

Consider a system of pipe work as shown in Fig. 1, having three cables or buses mounted upon spool insulators. Conductor *A* will have a mutual inductive effect on the pipe *m* in parallel with it. If *A*, *B* and *C* are close together, as is the case in a three-conductor cable, the magnetic effect of current flowing in *A* is neutralized by the return currents flowing in *B* and *C*, hence no electromotive force is induced in the surrounding conductors. In the case at hand, however, conductors *B* and *C* are such distance from the pipe *m* that their effect is small as compared with that pro-

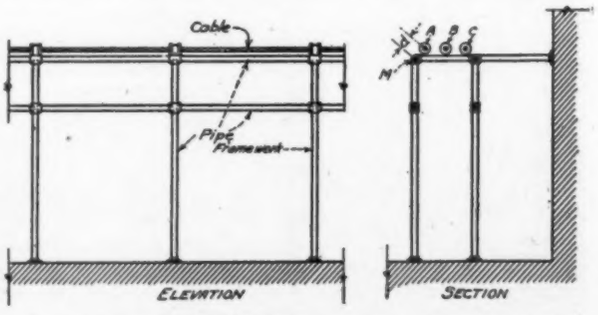


Fig. 1.—Typical Pipe Frame Bus Structure, Showing Arrangement of Pipework and Conductors.

duced by A. In other words, A will induce a certain electromotive force in m, which in turn will cause a current to flow in the pipe work. The magnitude of this current depends on the amount of current in A and the resistance of the pipe m.

Referring to Fig. 2, the mutual inductance between two parallel conductors a and b is given approximately by,

$$M = 2l\left[\log_e \frac{2l}{d} - 1 + \frac{d}{l}\right]$$

where

l = length of conductors in centimeters.
d = interaxial spacing of conductors in centimeters.
M = mutual inductance in centimeters.

If a current of I amperes flows in a, a certain electromotive force will be induced in b

$$E = MI.$$

where

E = e. m. f. induced in volts.
I = current in amperes in conductor a.
M = mutual inductance in henries.
= (mutual inductance in cm.) $\times 10^{-9}$.

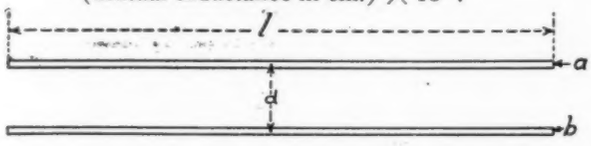


Fig. 2.—Parallel Conductors, for Calculation of Mutual Inductance.

The resistance of any conductor is given by

$$R = \rho\frac{l}{s}$$

where

R = resistance in ohms.
ρ = resistance per mil foot of conductor.
l = length of conductor in feet.
s = area of cross section in circular mils.

Neglecting the reactance produced by the magnetic properties of the iron pipe and assuming the resistance of the return path of the current is small, the value of current may then be written:

$$I = \frac{E}{R}$$

Consider an instance where the amperage, bus and pipe arrangements were as follows:

l = 50 feet = 1500 centimeters approximately.
d = 4 inches = 10 centimeters approximately.
I = 3000 amperes.
ρ = 63 ohms (for iron).
s = 1,050,000 circular mils.

Framework built up of 1½-inch standard pipe.

The mutual inductance, expressed in henries, is given by

$$M = 3000\left[\log_e \frac{3000}{10} - 1 + \frac{4}{1500}\right] \times 10^{-9}$$
$$= 1.41 \times 10^{-5} \text{ henries.}$$

Since

$E = MI$
$E = 1.41 \times 10^{-5} \times 3000$
$= 0.042$ volts.

The resistance of 50 feet of 1½-inch iron pipe is expressed by

$$R = 63 \times \frac{50}{1{,}050{,}000} = 3 \times 10^{-3} \text{ ohms.}$$

$$\therefore I = \frac{E}{R} = \frac{.042}{.003} = 14 \text{ amperes.}$$

This shows that induced currents are by no means negligible and may cause trouble and dangers not only during short-circuits but during normal times.

FEATURES OF BATTERY ROOM DESIGN.

Considerations Involving Floors, Walls, Ceiling and Battery Stillage.

It is a noted fact that rarely is sufficient consideration given to the housing of storage batteries. While a large storage battery is expensive, the cost of the structure for housing it is often comparatively low and unsuited to its purpose, and the life and maintenance of the battery suffer accordingly. In a paper entitled, "Large Batteries for Power Purposes," read before the Institute of Electrical Engineers recently by E. C. McKinnon, a number of details of battery housings were brought out that might to good advantage be given more consideration in the average battery house.

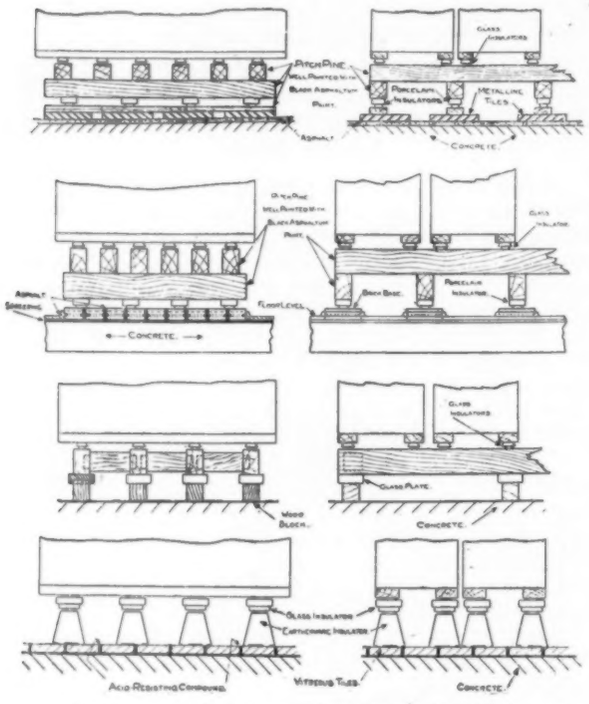
Ventilation is important, but it should be confined mainly to the removal of gases. Strong currents of air tend to drive off some of the acid spray which would otherwise be trapped by the spray arresters. They also induce abnormal evaporation of the electrolyte and unless uniformly distributed they are liable to set up uneven shrinkage of woodwork about the battery—containers, stillage, etc. Wherever there is a need for forced ventilation it is preferable to draw out the air, as the incoming air can be readily cleansed and the exhaust can be passed through a draught chamber equipped with acid filters or separators.

There is such a wide range of opinion as to the design of battery-room floors that rigid recommendations in this respect are not readily advanced. The matter is simplified if the battery room is a single-story one, in which case concrete or compressed ashes form a suitable base; with the latter, however, spontaneous combustion must be guarded against. In two or more storied buildings the trend is to employ reinforced concrete as a base.

What to place on the base is more problematical, and the choice ranges between cement, tar, bitumen, asphalt, vitrified bricks or tiles, wood blocks, and rubber sheeting. It is difficult to make an acid-tight floor with tiles or bricks set in cement. Asphalt is an excellent acid-proof covering, but it is not suitable to bear heavy concentrated weights, especially in a warm room. The best floor which can be used is probably one of vitrified brick or tile laid on concrete, with the joints pointed with an acid-resisting, asphaltic or bituminous compound. Tiles 8 or 9 inches square by 2 inches thick are preferable because this reduces the amount of jointing to be painted. The compound should be of such a quality that it will not become brittle with high or low temperature, but will remain plastic at all times. The tiles should be laid about ¼ inch apart so as to provide proper space by painting, and the tiles must be thoroughly dry, otherwise the compound will not adhere. In cases where the battery room is not directly on the ground the extra precaution should be taken of placing a layer of felt or paper treated with acid-resisting compound on the top of the concrete. Cement will not resist acid for long, but modern batteries do not weep acid to any appreciable extent, and a cement floor will be found thoroughly durable if periodically swilled down with water.

The slope of the floor is important and discussions

arise from time to time as to the merit of cross camber or through slope compared with a dead-level floor. The author advocates a gradual slope of 1 inch in 10 feet, from end to end of the room, or from each end to



Stillage of Various Forms for Storage Batteries.

the center terminating in gutters, and no fall or slope across the room. Gutters or channels along each gangway are superfluous, and unless covered by wood gratings are a source of danger to the operators. Any supports below the lowest tier of insulators form part of the building and not part of the battery. These supports of whatever description should terminate in a dead-level surface of uniform height. Wooden floor plates at right angles to the stillage have the advantage of distributing the weight, but are an obstruction when swilling down the battery room. Concrete pedestals, vitrified tiles, bricks, blocks or truncated cones, wood blocks with lead aprons or glass drip trays are all available to select from as a useful means of support and leveling.

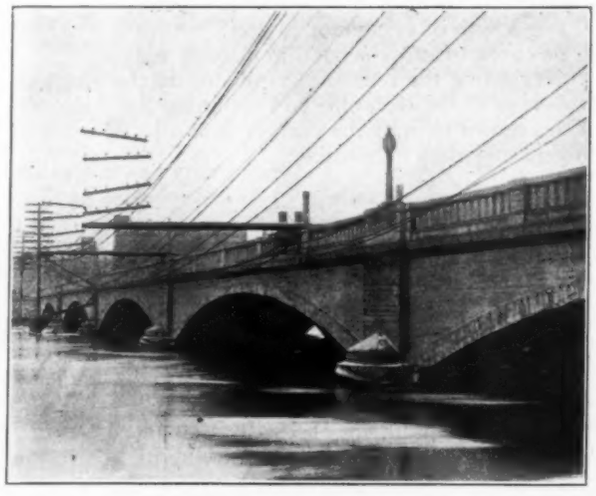
The construction of the walls is not of minor importance. Lime-washed walls are not very suitable, as the lime flakes off and makes the battery untidy, apart from the neutralizing effect on the lime on the acid in the cells. Mortar setting does not withstand the acid very well. A cement facing is good, especially if given a heavy coating of light colored paint. Vitrified bricks make a sound, durable job, but better appearance is obtained from glazed bricks or tiles.

The type of ceiling or roof of a battery room is of importance. Whitewashed ceilings are even more objectionable than whitewashed walls; metal work, however high the roof and however carefully painted, deteriorates quickly, shedding rust, ferric sulphate or zinc sulphate, as the case may be, on to the cells beneath. Ferro-concrete has the objectionable quality of "sweating." For appearance and durability a wooden ceiling painted or varnished has much in its favor.

In the accompanying illustration are shown different styles of stillage in vogue. The insulated earthenware pillars shown in the same figure form an excellent alternative to wood stillage. Iron or steel girders and cast-iron standards—favored items in specifications 15 to 20 years ago—have now rightly been abandoned as unsuitable for supporting a battery. Where wood stillage is employed it is advisable to split up the lengths into 18-foot sections to improve insulation. It is also advisable to insert transverse gangways where the battery rooms are built very long. No rule can be laid down, but 40 feet is found to be a convenient approximate maximum. Although frequently specified, it seems quite unnecessary to determine the width of the gangway by the length of the cell on either side of it. If space is limited, gangways of 2 feet wide are just sufficient; gangways 3 feet wide are comfortable, and no gangway need be more than 4 feet wide. Where cells are placed in double rows it is advisable to have at least 9 inches between opposite cells in order to clean down and replenish the protective coating of the containers. In batteries composed of very large cells this width should be increased to at least 18 inches.

A TEMPORARY RIVER SPAN.

While the old truss bridge across the Rock River was being replaced by a modern concrete arch bridge, the Rockford Electric Company had to build a special pole line across the river to carry their main transmission from the generating station on the east side to the business section of Rockford on the west side. Three submarine cables were already in use, but these were reinforced by aerial conductors, carried on a temporary line. This temporary line, which spanned a crossing 750 feet in width, the depth of the river being between 12 and 15 feet, was carried by Western red cedar poles, 55 feet in height, with 8-inch tops. All poles were surrounded by piles, which were bolted together. Special piling and guards were then constructed to prevent damage to the foundations during



Temporary Method of Carrying Conductors After Poles Had Been Removed.

ice floes. The total circuits carried by this temporary line comprised three 4000-volt circuits, six arc circuits, and 15 direct-current feeders of 500,000 circular mil.

The old truss bridge has now been torn down and the concrete arch bridge has replaced it. The new bridge is shown in the accompanying illustration, which also shows several interesting details of the transitory mode of carrying the circuits across the river. Some of the original poles can still be seen standing in the background, with their foundations of piling and stays.

Contracting-Construction

Useful Hints for Putting in Foundations for Electrical Machinery, Poles, Etc.,—Activities of the Contractors

SUGGESTIONS FOR CONCRETE WORK ON FOUNDATIONS.

By A. Gemmell.

The electrical contractor and plant electrician is occasionally called upon to build or help build concrete foundations for electrical apparatus, poles, etc. As such work is not exactly in his line, he is likely to go about this concreting in a rather awkward way, and therefore a few suggestions may perhaps be timely and valuable. It is not necessary to refer to the details of making a proper concrete mixture, as these are quite well known, but it should be emphasized that the proper amount of cement must be used and the mixture properly prepared.

In Fig. 1 is a sketch of a common wood form used for making square foundations. I have found that by putting on two wood strips as handles, this makes a much more handy arrangement, especially if the form

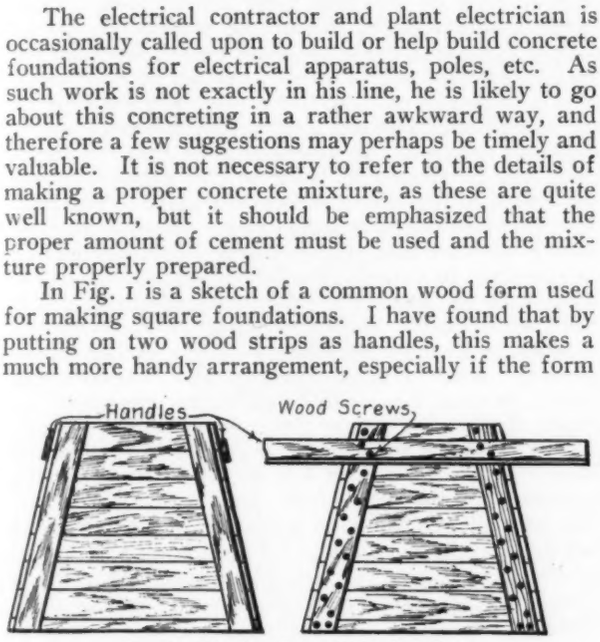


Fig. 1.—Wooden Form With Handles.

is large and therefore awkward to handle. Of course, the hole must be dug to the width of the bottom of the form, which means that when the form is lowered into the hole one has to reach over it to work it into the proper position. Many times when doing this the sides of the hole are knocked down before the form has been properly leveled up. By having handles like those shown, a form can be much more easily picked up and set in almost exactly the right place without danger of knocking down the edges of the hole. If it is found that the form for some reason or other has to be removed before the concrete is put in, it can very easily be removed by use of the handles. In the old way of handling the form it was usually rolled over and over and then dropped into the hole, which very often was thereby badly knocked out of shape, requiring considerable extra shoveling in cramped quarters or else producing a lob-sided foundation. By screwing the handles in place instead of nailing them, a much stronger form is obtained and the handles will not so readily be knocked off.

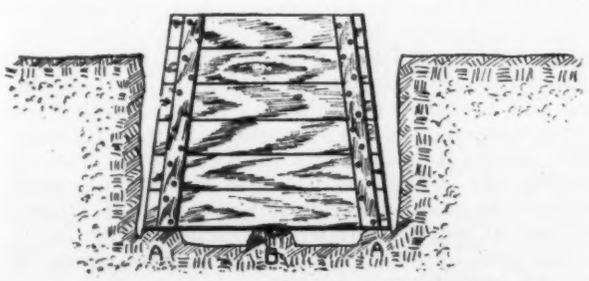


Fig. 2.—Leveling a Form on Three Points.

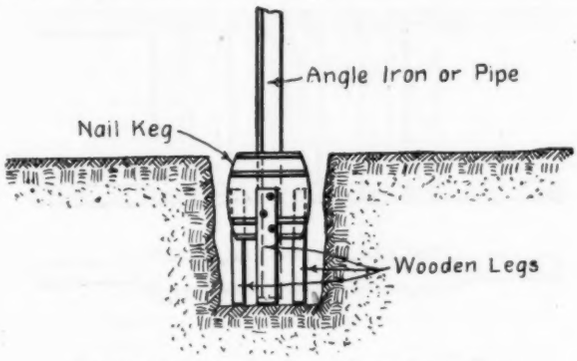


Fig. 3.—Keg Form for Poles, Fence Posts, Etc.

Fig. 2 shows a simple method of leveling up a form. Most commonly a little dirt is put under each of the four corners, but when this is done much more care has to be taken to level up the form than by the method illustrated. For instance, if two of the corners strike and the other two opposite ones are free, the form will rock; when driving down the solid corners in many cases they are likely to be driven too low and it is necessary to start all over again. The scheme shown provides for placing little mounds of dirt or gravel on the two front corners *A A*; *B* is the center of the rear side of the form where another small mound is made, thus giving three places on which to set the form instead of four. I have found that by this method the form can be leveled in about half the time used in the old scheme. The sides around the form can then be filled in a little to hold the form in place and the concrete poured in.

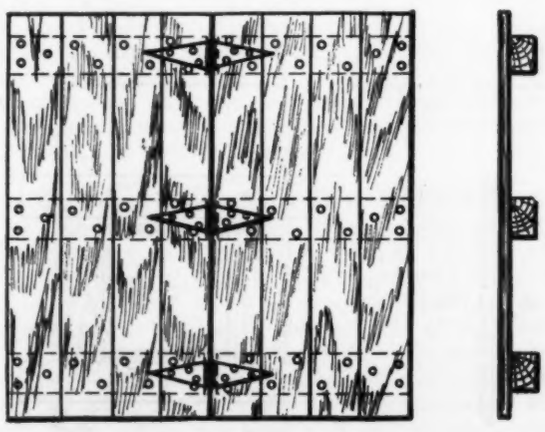


Fig. 4.—Folding Mixing Board.

A cheap method of making a form for small foundations, such as for concrete fence posts around transformer stations, etc., is shown in Fig. 3. As a rule, nail kegs, powder cans and the like can be found on the premises, which will serve to make a good ready-made form. If the foundation is to be deeper than the depth of the keg, three wooden legs can be nailed on, as shown, to make the required depth. The post is then set in place and braced. In case where such extension legs have been used on a form, concrete is poured in until the bottom of the keg is reached, then the space around the keg is filled with earth and the inside with concrete. Most posts are usually set in whatever hole has been dug and concrete then poured

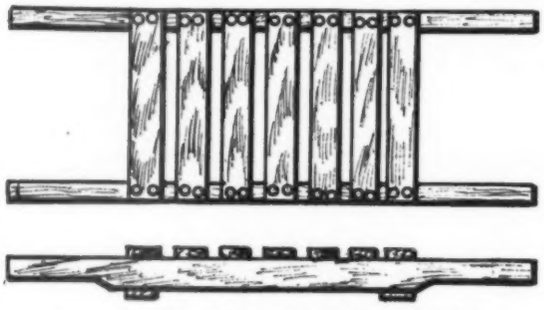


Fig. 5.—Handy Carrier for Bags of Cement.

in, which means much more concrete is required than where a simple form like that shown is employed.

A compact, folding concrete-mixing board is shown in Fig. 4. This will be found a useful part of equipment as it can be folded up and shipped more easily than an equivalent large board, which takes up too much room on a truck when moved from place to place. The hinges should be set in flush with the working surface of the board so that the shovels will not strike against them when mixing the concrete. Substantial cleats should be provided under the board as shown, to make it strong.

Fig. 5 shows a handy carrier that will be found useful for many things, such as carrying bags of cement, small transformers and various other heavy or bulky apparatus, especially in carrying such articles from the truck over rough places to the actual site of the foundation. Such a carrier can be quickly nailed together from lumber on hand, although it is well to make it up permanently as a part of the concreting equipment.

In the foregoing several suggestions were made about wooden forms. Where a large number of foundations have to be made of the same size, as for instance for a pole line where it is desired to have concrete bases for the poles, it is of advantage to use a metal form. This is especially true because of the present cost of lumber being high and because wooden forms are so quickly damaged as to be unfit for further use; frequently only part of the wooden form that is exposed is removed and the rest left in.

Fig. 6 shows a number of views of a metal form that will stand rough usage. Sketch *B* shows how the face of each of the four sides should look, and *C* shows a side view of one of the plates. It will be noticed that the upper corners are cut off and then the top edges turned over a little. *D* shows how the angle iron is drilled so as to fit the corners when the plates are assembled. The top view of the finished form is shown in sketch *E*. In assembling the form the angle irons can be riveted in place to two opposite plates and bolted to the other two opposite plates. The handles on two of the faces can be either bolted or riveted. Where bolts are used, the inside of the hole should be countersunk to prevent the bolt edge projecting. A form made in this way is quite light and strong. It is easily set in place. With the ordinary wood form it is common to fill the outside even with the surface of the ground. When a metal form is used, however, this cannot be done, but instead four boards are placed, as shown in sketch *E*, after the earth has been filled in about one-fourth the way up so as to hold the form in place. When the cement has set, loosen the four top bolts and rap the sides of the form with a light hammer or mallet. Chains or boards are put through the handles and the form raised off the foundation. Forms of the style shown will last a long time and will pay for themselves after being used the first two or three times.

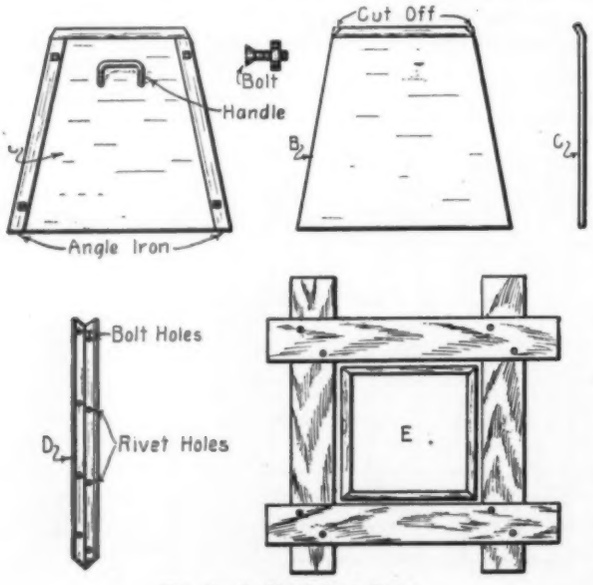


Fig. 6.—A Sheet-Iron Form.

NEW YORK CONTRACTORS TO HOLD OUTING.

The fourteenth annual outing of the Independent Electrical Contractors' Association of Greater New York will be held on July 13 at Midland Park and Hotel, Staten Island. A shore dinner will be served at 2:30 p. m. It is expected that representatives from all branches of the industry will be present.

AMONG THE CONTRACTORS.

The Memphis Electric Company has the contract for electrical work in the Church of the Seventh Day Adventists, Dunlap and North Parkway, Memphis, Tenn.

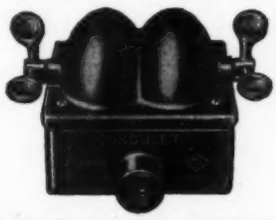
J. F. NePage, of the NePage, McKenny Company, probably the best known firm of electrical engineers and contractors on the Pacific Coast, with head offices in the Armour Building, Seattle, Wash., has returned from a trip to California points, visiting Los Angeles and San Francisco particularly. He reports that the San Francisco office has secured the contract for complete electrical installations in the Albers Brothers flouring mill at Oakland, Cal., the contract amounting to about $22,000. The company also has the contract for similar work in the elevator being erected at St. Johns, Ore., by the Portland Dock Commission at the price of approximately $41,000.

New Appliances

Gas-Tight Condulet Switch Covers — Inclosed Circuit Breaker for Motors—Electric Grill—Aid Crop Growing

MAKE PUSH-SWITCH INSTALLATIONS STEAM-TIGHT.

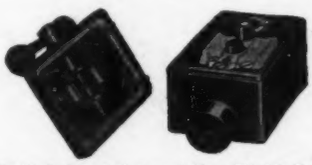
Double push-button switches, because of their ease of operation, have always been popular, but their use has been restricted by reason of the liability of moisture, gas or dust getting into the operating parts. The Crouse-Hinds Company, Syracuse, N. Y., has designed and placed upon the market a cover with a switch-operating mechanism for use with such switches, when installed on Condulets of either the FS or FD series, which eliminates these objectionable features. This cover is made in one and two-gang forms.



Two-Gang Gas-Tight Push-Button Switch Cover Installed on Condulet.

In one of the accompanying illustrations a two-gang cover is shown installed on a Condulet, while the other illustration is of a single-gang Condulet and cover with cover unmounted. Like the Condulet, the cover is a casting, either iron or brass, as specified. Iron covers are regularly finished in black enamel, although galvanized finish or any other plated finish will be furnished, if desired. Marine finish is standard for brass covers.

The mechanism which operates the push buttons is under the cone of the cover and is controlled by a shaft, flattened at its inner end and extending through the side of the cover where it terminates in the operating handle. That portion of the shaft which passes through the cover is provided with grooves containing



Single-Gang Switch Condulet and Gas-Tight Cover Therefor.

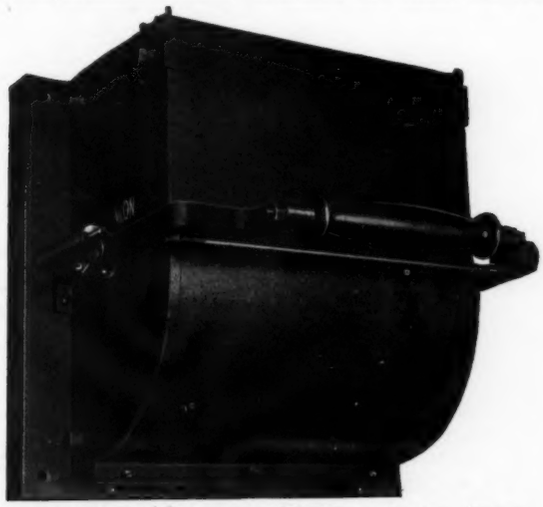
hard grease which effectually seals the bearing, and a rubber gasket likewise seals the joint between the cover and Condulet. "On" and "off" indicators, cast on the ends of the handle, facilitate the operation of the switch.

With this cover and the necessary Condulet, it is now practical to use push switches in places where excessive moisture, explosive or corrosive vapors or fine dust circulate in the atmosphere, as in marine use, ammunition plants, refineries, textile and flour mills, and the numberless other locations which suggest themselves to the electrician.

INCLOSED NO-VOLTAGE CIRCUIT-BREAKER.

Motor circuits should be protected by means of no-voltage devices to prevent damage to the machine in case power is suddenly restored after having been cut off. Since it is coming to be the best practice to inclose the line switch for the motor, there has arisen a demand for inclosed types of no-voltage circuit-breakers for induction motors for which other no-voltage release has not been provided.

An inclosed breaker of this type has recently been placed on the market by the Roller-Smith Company, 223 Broadway, New York City. The inclosing case is built of substantial steel and is made in two sizes to fit the 45 and 100-ampere circuit-breakers. Its use obviates the need for preparing a separate inclosure for the breaker. These breakers are made for four



Inclosed Plain No-Voltage Breaker for Induction Motors.

voltages, 110, 220, 312 and 440. At the left side of the case there is a target showing whether the breaker is on or off. The handle projecting from the front is arranged so that it can open the breaker by slight upward pressure, or close the breaker by a slight downward pressure. The top and bottom of the breaker are provided with wiring inlets, thus making connection of the outfit very convenient.

GRILL WITH ALUMINUM PANS.

To meet the demand for a grill with rustproof pans, Landers, Frary & Clark, New Britain, Conn., have brought out their E986 four-heat round grill. This is similar to their regular E984 round grill but has two aluminum pans in place of the regular nickel-plated steel equipment. Being of solid seamless aluminum, these pans will withstand long boiling and soaking in water without damage and are desirable equipment for round grills. The pans may also be purchased separately.

NEW METHOD OF USING ELECTRICITY TO AID GROWING CROPS.

For many years experiments have been carried on both in this country and England with various methods of aiding crop growing by electricity. The method illustrated herewith, while not new in theory, is entirely new in the method of applying the theory to actual work. The method of making such a plan possible by treating the seeds is also new both in theory and practice. Instead of the overhead structure, successfully used in England except for cost, which involves the stringing of wires and setting poles over the area to be electrified, no wires or equipment are in the area occupied by the crops. The losses are by this method much reduced so that smaller and less costly equipment is possible. The equipment is not only cheaper, but the operation costs are said to be reduced to an extremely small amount. The set can be operated from any commercial lighting circuit.

The high-frequency current used is literally driven through the surface of the soil from special distributing electrodes imbedded below the surface of the soil about 6 inches and arranged parallel to each other and on opposite sides of the field, along the fence lines.

The control of the electricity is brought about by metallically coating the seed with a finely divided non-deteriorating metal before planting, thus not only creating lines of low resistance but also creating a condition analogous to the coherer of the wireless set, since high-frequency waves are drawn to anything metallic. After the germination of the seed the metallic element is deposited in the heart of the roots of the plant, thereby increasing the rapidity of growth, volume and quality of production and earlier maturity.

Test made during last summer at Lombard, Ill., on 11 acres of corn and a few rows of sugar beets are given below.

CORN.

(1) Came up three to four days sooner.
(2) Increased the germination 31 to 39 per cent.
(3) Increased the rapidity of growth 30 to 40 per cent.
(4) Increased the volume of stalks 35 to 40 per cent.
(5) Increased the corn production (estimated) 30 to 40 per cent.
(6) Increased the money value (estimated) per acre $25 to $35.

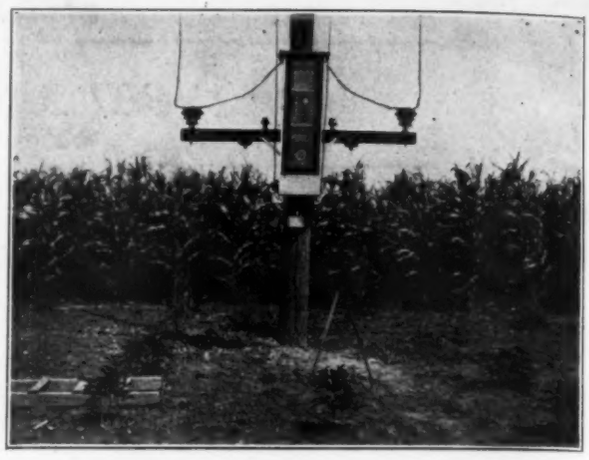
SUGAR BEETS.

(1) Increased the production in weight volume 15 per cent.
(2) Increased the sugar content 14 per cent.
(3) Increased the money value per acre over $50.

The above was done at a cost of less than 50 cents per acre for electricity and metallically coating the seed, and the apparatus installed cost less than $200.

The final average height of the electrified corn was over 10 feet. It is generally believed that the principal effect of the electricity is the addition of nitrogen to the soil, or the actual nitrification of the soil, essential to the well being of plant life. Last summer was generally cold and wet, which from an electrical point of view was adverse to the process, i. e., better results may be expected in a drier season.

An increase in corn production only as much as the lowest values given in the table would certainly relieve the food shortage if only a few per cent of the farms were to be electrically equipped. One very distinct advantage is that it will allow a farmer to cut off nearly one-half of the growing time, thereby having the crop in the full mature stage before there was any possible chance for frost to nip it, such as was generally experienced in many parts of the country last fall.

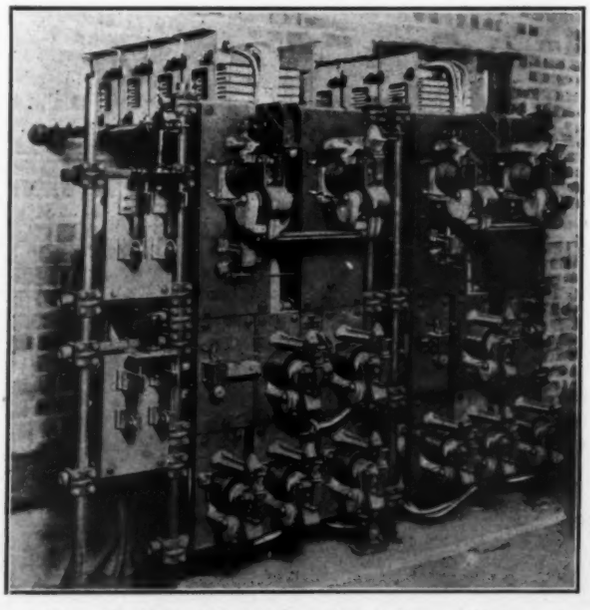


Electrical Crop-Growing Apparatus Placed at Edge of a Corn Field.

The inventor of this apparatus and method is R. D. McCreary, of Chicago, recently an equipment engineer for the Western Electric Company. The American Electro Agriculture Company, Borland Building, Chicago, has been organized to take over the patent rights and market the apparatus.

MAGNETIC CONTROL FOR STEEL-MILL MOTORS.

The illustration below shows a type of electromagnetic control very successfully used for direct-current steel-mill motors up to fairly large sizes. It is made by the Westinghouse Electric & Manufacturing Company and is employed extensively at the new mills of the Mark Manufacturing Company, Indiana Harbor, Ind., described in our issue of May 11. The equipment is exceptionally rugged and is built for severe service.



Magnetic Control Panels for Direct-Current Motors.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

WATERVILLE, ME. — Lockwood Company, Bridge and Water streets, is having plans prepared for the construction of a one-story hydroelectric power plant at its works. I. W. Jones, Milton, N. H., is engineer.

WELLESLEY, MASS. — Wellesley College is having plans prepared for the construction of a one-story addition, about 25x46 feet in size, to its boiler plant. French & Hubbard, 88 Pearl street, Boston, are engineers.

CUMBERLAND, R. I. — Lonsdale Company, Lonsdale, near Cumberland, has awarded a contract for the construction of a transformer building at its plant. The J. W. Bishop Company, 109 Foster street, Worcester, Mass., is the contractor.

STAMFORD, CONN.—Stamford Gas & Electric Company, 11-17 Bank street, has awarded a contract for the construction of a brick pump and screen plant and valve house at its plant to cost about $10,000. The Vuono Construction Company, Bank building, Stamford, is the contractor.

BINGHAMTON, N. Y.—Binghamton Light, Heat & Power Company has contracted with the Binghamton Cutlery Works for supplying electric power for the new plant to be established by the company. Operations will be inaugurated about July 1, and about 150 horsepower will be required for initial work.

JAMESTOWN, N. Y.—Art Metal Construction Company, Jones street and G avenue, has had plans prepared for improvements and alterations in its boiler plant, and the erection of an addition. F. A. Shoemaker, Builders' Exchange, Buffalo, is engineer.

NEW YORK, N. Y.—Young & Egan, Inc., manufacturer of electric lighting fixtures, etc., has announced the removal of its offices and show rooms from 489 Fifth avenue to 21 East Fortieth street.

NEW YORK, N. Y.—Chatham Electric Motor Corporation has leased property at 207-209½ Wooster street, to provide for extensions.

NEW YORK, N. Y.—DeForest Radio Telephone & Telegraph Company, 1391 Sedgwick avenue, has acquired property, about 25x95 feet, on Sedgwick avenue, near One Hundred and Seventy-first street, to be used, it is said, for extensions.

SAYVILLE, L. I., N. Y.—The United States Government, Navy Department, Brooklyn, has awarded a contract to the E. J. Electric Installation Company, 221 West Thirty-third street, New York, for the installation of a new electric flood lighting system at the local wireless station.

SCHENECTADY, N. Y.—General Electric Company has awarded a contract for the construction of a drop forge building addition to its local works. The Samuel Austin Company, 14230 Euclid avenue, Cleveland, Ohio, is the contractor.

WATERTOWN, N. Y. — Northern New York Utilities Company, 137 Arsenal street, is considering plans for the construction of a power station at Black river. The development is estimated to cost in the neighborhood of $500,000. James Brownell, Strickland, is engineer.

DOVER, N. J.—New Jersey Power & Light Company has been awarded a contract by the Thomas Iron Company for supplying additional power to its plant for the operation of a 200-horsepower motor recently installed to be used in connection with a new hoist, which will be operated on a 24-hour per day schedule, seven days per week.

GLOUCESTER, N. J.—Public Service Electric Company has completed improvements in the electric street-lighting system and inaugurated operations.

GLOUCESTER, N. J.—Delaware & Atlantic Telephone Company has completed arrangements for the immediate occupation of its new telephone exchange plant on Hudson street. Electric conduits to the new plant are now being installed.

HARRISON, N. J.—General Electric Company, Schenectady, N. Y., has had plans prepared for the erection of a one and three-story producer building at its local works, about 50x100 feet in size. Edward M. Waldron, Inc., 665 Broad street, Newark, is the contractor.

HARRISON, N. J.—Standard Wire Company, 11 Passaic avenue, manufacturer of electrical wires, etc., has acquired the three-story brick plant formerly occupied by the Federal Wire Cloth Company on Passaic avenue, fronting on the Passaic river. The plot is about 110x200 feet in dimension.

JERSEY CITY, N. J.—Hoffman & Elias, 549 Colbs avenue, New York, have submitted the lowest bid to the city commission for electrical work in connection with the new school buildings Nos. 6 and 23, at $11,489 and $12,179, respectively. These structures will be erected at the respective costs of $754,000 and $780,000.

NEWARK, N. J.—Nitrogen Electric Company, 38 Spring street, manufacturer of nitrogen-filled electric lamps, has leased property at 50 Spring street, to provide for extensions.

OGDENSBURG, N. J.—The boiler plant at the local limestone quarry of the Wharton Steel Company was destroyed by an explosion on May 22. It is said the company is considering plans for the immediate reconstruction of the structure.

PERTH AMBOY, N. J.—Final arrangements have been made by the Standard Underground Cable Company, 26 Washington street, for the purchase of about 36 acres of land on Woodbridge township, and the deed for the property has been recorded. The company is said to be planning for the construction of a large new plant on the site.

POMPTON LAKES, N. J.—Plans have been completed by the Borough Council for the immediate construction of a two-story brick hydroelectric plant, about 40x67 feet in size, to be located on Corning Lake. The council has recently authorized a bond issue for $46,000 to provide for the structure. S. Firestone, Granite building, Rochester, N. Y., is engineer.

PRINCETON, N. J.—The borough council is considering plans for immediate improvements in the electric fire alarm system.

TRENTON, N. J.—Trenton & Mercer County Traction Company is now supplying power to the Trenton, Bristol & Philadelphia Traction Company to assist in the operation of the latter company's traction system.

EASTON, PA.—Pennsylvania Utilities Company has filed notice with the Public Service Commission of a bond issue of $110,000 to provide for improvements, extensions, etc.

ELWOOD CITY, PA.—The Pennsylvania Power Company has filed notice with the Public Service Commission of the issuance of bonds for $9,000 to provide for improvements, etc.

ENOLA, PA.—Pennsylvania Railroad Company has had plans prepared for alterations and improvements in its local power plant and engine house.

PHILADELPHIA, PA.—The United States Government has awarded a contract for the construction of the proposed one-story brick power house and one-story brick and concrete transformer buildings to be located at the League Island Navy Yards. The work is estimated to cost $129,986. Thomas Reilly, Seventh and Sedgley streets, is the contractor.

PHILADELPHIA, PA. — Mifflin Chemical Corporation, Delaware and Tasker streets, has had plans prepared for alterations and improvements in its boiler plant. Frank E. Hahn, Philadelphia, is architect.

PHILADELPHIA, PA.—The Link-Belt Company, 2023 Hunting Park avenue, has filed plans for the erection of a one-story brick addition to its boiler plant. Alterations and improvements will also be made in the existing structure.

READING, PA.—Announcement has been made by the Reading Transit & Light Company of an increase of one cent per hour in the wages of the men employed on the traction system covering Norristown, Reading, Lebanon and neighboring suburbs, effective June 1.

WAYNESBORO, PA.—Chambersburg, Greencastle & Waynesboro Street Railway Company has commenced the construction of a large new steel tower to be located near the new building of the company just completed in East Main street. The tower will receive the high tension current from Security, Md.

BALTIMORE, MD.—The city has had plans prepared for the immediate installation of electric conduits, wires, etc., in Hollins street, Carrolton avenue and Hollins Market. C. H. Osborne is inspector of buildings.

FREDERICKSBURG, VA. — The board of directors of the State Normal School will erect an electric power house and laundry. Address C. H. Russell, president.

NEWPORT NEWS, VA.—Chesapeake & Potomac Telephone Company, Lexington street, Baltimore, Md., has purchased property, about 75x175 feet in size, as a site for its proposed new telephone exchange plant to cost $40,000.

GIBSONVILLE, N. C.—Gibson Milling Company is considering plans for the construction of an electric power system from Summers Mill to Gibsonville, a distance of about five and one-half miles.

BRANCHVILLE, S. C.—Plans are under consideration by Prescott Orr for the immediate installation of an electric lighting plant.

ATLANTA, GA.—On July 10 the question of issuing $75,000 in bonds for a generating plant at the city disposal works will be submitted to vote. Asa G. Candler, mayor.

FLORIDA CITY, FLA.—De Berry Brothers are considering plans for the installation of an electric-lighting plant.

SARASOTA, FLA.—The city is having plans prepared for the erection of a new power plant to generate electricity for the purpose of street lighting and the operation of the water works. W. H. Ginn, Sanford, Fla., is engineer.

NORTH CENTRAL STATES.

FRANKLIN, IND.—Franklin Water, Light & Power Company has petitioned for authority to issue bonds for extension and improvements. Address S. R. Reno, manager.

INDIANAPOLIS, IND. — Claims have been filed with the Marion county commissioners by the Indianapolis Light & Heat Company and the Merchants Light & Heat Company asking a refund of what the companies claim to be illegal taxes paid by them to the county treasurer May 6. The former company asked for a refund of $17,024.72, with 6 per cent interest since May 6 and the Merchants Heat & Light Company for $14,728 with 6 per cent interest from the same date.

LAFAYETTE, IND.—The LaFayette Telephone Company has asked the Indiana Public Service Commission to confirm its purchase of the business of the Central Union Telephone Company in that city. The purchase price is $55,000. The Central Union Telephone Company would continue to maintain an office in LaFayette for long distance calls only, but would cease to operate a local exchange business. The Commission has set June 17 as the date for the hearing.

PERU, IND.—Peru Electric Manufacturing Company, which has been managed by Charles G. Burton, has been sold to Frank Moeck, of Peru, by C. H. Brownell and the Citizens' National Bank. The latter parties purchased the business at a receiver's sale several years ago. The purchase price has been withheld.

ATHENS, ILL.—Permission has been extended the Cass county Telephone Company and C. W. Carr, representing the Athens Electric Light Company, to erect a high tension wire over the tracks of the Chicago, Peoria & St. Louis Railroad Company.

ROCKFORD, ILL.—A special committee has been appointed by Mayor Rew to investigate the proposition of a municipally owned electric light and power plant. The committee is composed of Aldermen Clothier, Ogren, Murphy, Groon and Johnson.

CAMERON, MO.—A force draft system for the power house was referred to the electric light committee for investigation.

KANSAS CITY, MO.—A. Holtman Heating Company is considering plans for the rebuilding of its two-story reinforced-concrete plant, about 110x125 feet, at Eighteenth and Holmes streets, recently destroyed by fire. The new works are estimated to cost about $90,000. Smith, Rea & Lovitt, Kansas City, are architects.

LEES SUMMIT, MO.—Green Light & Power Company is considering extensions in its transmission system from Lees Summit to Little Blue.

PLEASANT HILL, MO.—L. K. Green & Son, the Pleasant Hill electric light and power company, have bought the H. P. Duan electric light plant at Adrian, Kans.

ST. LOUIS, MO.—Union Electric Light & Power Company has increased its capital from $21,240,000 to $22,240,000. Improvements will be made.

CEDAR, KANS.—J. E. Sarvers, Solomon Valley Light & Power Company, has stated that, with the city's permission some changes will be made in the wiring system.

CHENEY, KANS.—Election was held recently to vote $15,000 bonds for purpose of purchasing, extending and improving an electric light plant. Keith E. Cox, city clerk.

GARNETT, KANS.—Election has been called for June 4 to vote $65,000 in bonds for the purpose of improving the electric lighting and water plant and furnishing light, power and water to the inhabitants of said city. F. S. Mitchell, city clerk.

HUDSON, KANS.—German Valley Telephone Co. will soon commence work on the new Central office on Main street.

LARNED, KANS.—At the meeting of the city council May 8 a contract was granted to Nathan L. Jones, allowing him the privilege of purchasing the surplus energy from the municipal electric light plant at a price based on the cost of electric service plus a profit. Mr. Jones and his associates are making application to the charter board of the state for a charter to form a corporation, which will at once proceed to build a transmission line up the Pawnee Valley and from the station of Frizell south to Garfield to connect with a line just completed by Mr. Jones from the line running to Lewis and Belpre from the plant at Kinsley.

MANKATO, KANS.—Jewell County Telephone Company and the Mutual Company have been invoicing the Mutual plant and equipment with a view to consolidating the two systems. After the inventory has been completed, the stockholders of the Mutual Company will have a meeting to vote on the question of the sale of their company to the Jewell County Company.

WELLSVILLE, KANS.—C. A. Smith has petitioned for authority to supply the town of Gardner and Edgerton with electricity by transmission.

SOUTH CENTRAL STATES.

RECTOR, ARK.—Luther King is preparing plans for construction of a power plant.

GUYDAN, LA.—Bonds in the sum of $20,000 for water works and $15,000 for electric light system have been voted.

NEW ORLEANS, LA.—Liberty Manufacturing Company, recently organized, has acquired a manufacturing building at Carrollton avenue and Oleander street, and is planning for immediate operations for the manufacture of electric machinery.

DATES AHEAD.

Electrical Contractors' Association of Georgia. Annual meeting, Tybee Island, Ga., June, 1918. Secretary, Dan Carey, 614 Chamber of Commerce building, Atlanta, Ga.

American Society of Mechanical Engineers. Spring meeting, Worcester, Mass., June 4-7. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

National Electric Light Association. Annual convention, Hotel Traymore, Atlantic City, N. J., June 13 and 14. Secretary, T. C. Martin, 33 West 39th street, New York City.

Texas State Association of Electrical Contractors. Annual meeting. Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, Atlanta, Ga., June 19-20, 1918. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

American Institute of Chemical Engineers. Summer meeting, Berlin, N. H., June 19-22. Headquarters, Mt. Madison House, Gorham, N. H. Secretary, John C. Olsen, Brooklyn, N. Y.

United States Independent Telephone Association. Annual convention, Hotel La Salle, Chicago, Ill., June 25-28. Secretary, W. S. Vivian, 19 South La Salle street, Chicago, Ill.

American Institute of Electrical Engineers. Annual convention, Atlantic City, N. J., June 26-28. Secretary, F. L. Hutchinson, 23 West 39th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 10-12. Secretary, D. L. Gaskill, Greenville, Ohio.

National Association of Electrical Contractors and Dealers. Annual convention, Cleveland, Ohio, July 17-20. Secretary, Harry C. Brown, 101 West 40th street, New York City.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual meeting, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

International Association Municipal Electricians. Annual convention, Atlanta, Ga., September 24-27. Secretary, Clarence R. George, Houston, Tex.

VILLE PLATTE, LA.—The city is planning for improvements and extensions in the electric lighting system to cost about $5,000.

POTEAU, OKLA.—Citizens' Consolidated Power & Electric Co. chartered with $25,000 capital stock by Wiley W. Lowrey, H. J. Fowler, E. S. Hutton, Poteau.

STONEWALL, OKLA.—Oklahoma Power & Transmission Company contemplates extending electric transmission system to Stonewall.

YALE, OKLA.—The city is considering a bond issue for $200,000 to provide for the construction of an electric light system and water works.

MERCEDES, TEX.—Mercedes Water, Light & Power Company will purchase an engine and generator. Address the manager.

WESTERN STATES.

BELLINGHAM, WASH.—A power plant that is to be larger than the one destroyed by fire some time ago is to be erected by the Boundary Red Mountain Mine this summer at a cost of several thousand dollars.

EVERETT, WASH.—The United Steel Company, which is to install an electric furnace in addition to the two reheat furnaces which it proposes to install in its plant here is asking bids for erection of its buildings. The main building is to be 70x200 in dimensions. Two large magnets operated by electricity for handling scrap will be a part of the equipment.

SEATTLE, WASH.—Council has passed over the veto of the mayor a bill granting a franchise to the National District Telegraph Company to install a signal alarm system in the city.

SEATTLE, WASH.—Work is to start at once on construction of the $30,000 concrete power station of Stone & Webster for the Puget Sound Traction Light & Power Company at 6500 14th avenue South.

SEATTLE, WASH.—An ordinance has been passed by the city council authorizing an appropriation of $100,000 for municipal railway construction from the bond fund.

SEATTLE, WASH.—Plans are under consideration by the Rothert Process Steel Company, 622 Harriman street, for the installation of a 10-ton electric furnace at its plant in connection with other extensions.

SPOKANE, WASH.—The city is planning for improvements and extensions in the electric street lighting system.

TACOMA, WASH.—A bond sale is to provide funds for extension of the tide flats line and the purchase of new equipment.

WENATCHEE, WASH.—Chelan Falls Power Company has filed application with the Douglas county commissioners for permission to construct and operate electric transmission lines over certain sections of the county.

PORTLAND, ORE.—Northwestern Electric Company has been granted a permit to erect a one-story $250,000 power plant at the foot of Lincoln street. Charles C. Moore & Company are the engineers on the job and construction work will be done by the owners.

RICHMOND, CAL.—The city council has approved an appropriation of $12,000 to provide for the purchase of the necessary electrical equipment in connection with the municipal wharf now in course of construction.

RIVERSIDE, CAL.—Southern Sierra Power Company has recently purchased one of the reinforced-concrete buildings of the Riverside Abstract Company on Eighth street. The company is planning to remodel the building and construct an addition, and will use the structure for office purposes.

SAN PEDRO, CAL.—In connection with extensive additions to the plant of the Southwestern Shipbuilding Company located south of Fish Harbor Wharf, a new transformer station, about 20x27 feet will be erected.

FRESNO, CAL.—The city is planning for the immediate installation of an electrolier system on South Van Ness avenue. Plans have been prepared by Clarence Murray, city engineer.

JACKSON, CAL.—Gage Mining Company, located near Shawmut, is considering plans for the complete electrification of its mines, power to be supplied by the Sierra & San Francisco Power Company.

LOS ANGELES, CAL.—Pacific Electric Railway Company has had plans prepared for the construction of a power plant, about 60x120 feet, reinforced-concrete, brick, and steel, in connection with the erection of a number of other buildings at Torrance.

LOS ANGELES, CAL.—The board of Public Utilities Commissioners has recently handed down an order requiring the Pacific Electric Railway Company to double-track its traction line between Wilmington and Long Beach.

LOS ANGELES, CAL.—Pacific Electric Railway Company has had plans prepared for the construction of a one-story brick electric sub-station, about 32x50 feet, to be located at Slauson Junction, Slauson and Long Beach avenues.

OCEANSIDE, CAL.—Plans are under consideration by the Board of Supervisors for the installation of an electric street lighting system.

RED BLUFF, Cal.—The city has had plans prepared for the immediate installation of a new municipal lighting system.

PROPOSALS

CENTRIFUGAL PUMP.—Bids will be received until 8 p. m., June 3, by J. M. Aretz, city clerk of Chaska, Minn., for installing one 4-inch, 2-stage high lift centrifugal pump, directly connected to a 20-horsepower, 1,800 RPM, 60-cycle, 220-volt G. E. squirrel-cage induction motor with hand compensator.

ELECTRIC LIGHT LINE.—Bids will be received until 2 p. m., June 3, by G. W. Wray, auditor of Union county, for constructing an electric light line to county infirmary.

ELECTRIC LIGHT SYSTEM, ETC.—Bids will be received on June 6 for completing the Central avenue viaduct at Kansas City, Mo. The specifications include an electric light system, wiring lights and poles. Address H. Payne, city clerk, Kansas City, Mo.

INCORPORATIONS

MOBILE, ALA.—Baerman-Hugenot Electric Company. Capital, $15,000. To engage in a general electrical contracting capacity. Incorporators: R. Baerman, H. Baerman, and E. T. Hugenot.

PINE BLUFF, ARK.—Pine Bluff Battery Company. Capital, $10,000. To manufacture electric batteries. Incorporators: G. M. Rudd, H. A. Techumo, and R. G. Craig, Pine Bluff.

DOVER, DEL.—National Fire & Burglary Prevention Company. Capital, $150,000. To manufacture fire and burglar alarm systems, etc. Incorporators: M. M. Clancy, F. A. Armstrong, Wilmington.

INDIANAPOLIS, IND.—Higgins-Lalley Light Company has been incorporated with capital of $7,500 to buy and sell light and power plants, equipment and accessories. The incorporators are George W. Higgins, H. M. Higgins and Larz A. Whitcomb.

PRINCETON, IND.—Princeton Utilities Company has been incorporated with a capital of $40,000 to supply light, heat, power and water for Princeton and surrounding territory. Among those interested are James C. Johnston, Sam T. Heston, H. E. Bacon, Jacob L. Knauss, and Samuel L. May.

HAZARD, KY.—Electrical Supply & Repair Company. Capital, $25,000. To manufacture electrical supplies. C. E. Carlin is the principal incorporator.

NEWARK, N. J.—Threadless Pipe Fitting Company. Capital, $30,000. To manufacture electrical appliances. Incorporators: Joseph G. Fenster, Samuel Lederman, and Edward S. Schwartz, Newark.

NEWARK, N. J.—Electric Service Company. Capital, $250,000. To engage in a general electrical engineering capacity. Incorporators: William J. Van Vleck, Charles D. Winters, and George H. Palmer, Newark.

UNION HILL, N. J.—Carbon Company, Inc. Capital, $100,000. To manufacture incandescent lamps. Incorporators: Edward J. Simon, John T. Simon, and Mydron D. Grove, Weehawken.

WEST ORANGE, N. J.—Edison Primary Batteries Company has been incorporated with an authorized capital of $500,000 as a subsidiary of the Thomas A. Edison Company, Inc. Incorporators: Thomas A. Edison, Charles Edison, and Stephen B. Mainbert.

CLEVELAND, OHIO.—Freeman Electric Company has been incorporated with a capital of $10,000. N. K. Freeman and Benjamin Feinsilber, incorporators.

SAN ANTONIO, TEX.—B. V. D. Electric Manufacturing Company was recently incorporated with a capital of $25,000. John B. Atroff and Charles L. Vandunker are the incorporators.

CLARKSBURG, W. VA.—Home Electric Equipment Company has been incorporated with a capital of $10,000 to install electric light systems. Harlow T. Gates and Andrew I. Bayle, of Pittsburgh, are the incorporators.

Trade Activities

Cutler-Hammer Receives Certificate of Endorsement—Change in Ownership of the Stentor Electric Company

The Klaxon Company, of Newark, N. J., has absorbed the Stentor Electric Manufacturing Company, of Long Island City, N. Y. The Autophone and other loud-speaking telephone instruments, formerly manufactured by the Stentor Electric Manufacturing Company, will be marketed by the Klaxon sales organization. The Autophone business will be handled from the Klaxon Company's office in the Hyatt building, Detroit, Mich.

National X-Ray Reffector Company, 235 West Jackson boulevard, Chicago, has issued a new bulletin on industrial lighting with X-ray reflectors. This points out the many benefits that result from good shop lighting, showing how production is increased, accidents are prevented, less work is spoiled, working conditions are materially improved, all at comparatively low lighting cost. The advantages of using silvered-mirror glass reflectors are explained and the several types of these units are described and illustrated. A large number of views are given of typical installations of this equipment, also one showing flood lighting with the company's projector units.

Crocker-Wheeler Company, manufacturer of electric motors, generators and transformers, both alternating and direct current, Ampere, N. J., is distributing a number of new bulletins. One of these, Bulletin 183, superseding Bulletin 157, takes up the use of the motor drive for printing machinery and demonstrates by illustrations the practical manner in which Crocker-Wheeler motors are applied to all kinds of machinery in printing and publishing establishments. The great advantages obtained by this means have been recognized by every progressive printer and publisher, and these may be summarized as increased output, ease of control, saving in power, increased light, freedom from dirt, flexibility of arrangement with its consequent economies, and increased efficiency. Several forms of motors are described and illustrations of a few typical cases of hundreds of applications of Crocker-Wheeler motors to such machinery are given. Bulletin 184, which supersedes Bulletin 153, describes and illustrates direct-current lighting and power generators of direct-connected and engine types, and among the special features of design and construction claimed for these products are their compactness, simplicity and durability. Another bulletin, No. 185, discusses the use and requirements of coupled and belt types of alternating-current generators. Each and every part of these generators is illustrated and described in detail, and the many advantages afforded by these types are clearly brought out.

Crouse-Hinds Company, Syracuse, N. Y., has ready a complete description with illustrations and listings of the new steam-tight push-switch covers for condulets of the FS or FD series. A copy of this descriptive matter and data, which is designated as condulet bulletin No. 1000H, will be sent free on request to the company.

Ward Leonard Electric Company, Mount Vernon, N. J., is distributing circular No. 502, dealing with the Ward Leonard current regulating rheostat. This rheostat is of a low resistance, especially developed for use with 30-40-volt individual lighting plants and the 20-ampere Mazda projector lamp, and is equipped with a high grade ammeter calibrated to great accuracy. A diagram showing connections for regulating resistance for 30-40-volt isolated lighting plants, and complete instructions as to the method of operation are contained in the pamphlet. Another circular issued by the company illustrates and describes the Universal charging rheostat, for charging of starting, lighting and ignition batteries. This rheostat can be used to charge any number of cells from one to the maximum. Detailed information as to charging, method of operation, etc., is given in the pamphlet.

Cutler - Hammer Manufacturing Company, Milwaukee, Wis., is in receipt of a certificate of test and endorsement of its "Seventy Fifty" switch. This certificate was accompanied by a report of the test made by De Witt V. Weed, Jr., expert in charge of test, which contains among other information, reference to the ready means of attaching this feed-through switch at convenient points of flexible connections used with any electrical appliance. It also mentions how invaluable this switch is attached to the cord of an electric iron since, the report goes on to say, "the current must frequently be turned on and off and disconnecting the plug is usually annoying. With the switch installed pressure on the light-colored button allows the current to flow, and the black button turns it off. This device not only saves the operator inconvenience, delay and mental anguish, but it prolongs the life of the appliance by eliminating sparking at the plug, reducing the wear on the terminals and decreasing repairs." All tests made by the Tribune Institute are practical, the appliance or device being given actual service, approximating average household conditions and certificates are awarded when the number of points given a device is above 75. The C-H Seventy Fifty Switch was given an award of 93 points, getting the highest possible marks for construction, efficiency of design and efficiency of operation.

Cooper Hewitt Electric Company, Hoboken, N. J., has in recent months completed some very important installations of Cooper Hewitt lamps in large industrial works engaged on government contracts. Included among these is the Ford plant building submarine chasers at Detroit, where 1,600 lamps were installed. The plant of Dodge Brothers, Detroit, busily engaged on ordnance work, has 1,200 Cooper Hewitt lamps. The Moline (Ill.) plant of the Root-Vandervoort-Wagner Company, making naval guns, has installed 500 lamps. Another large plant so equipped is that of the Edward Valve & Manufacturing Company, East Chicago, Ind. Each of these plants is now working 24 hours a day and it has been found that the men turn out more work at night in some cases than by day. Cooper Hewitt Company states that the average results obtained from some 40 or 50 installations of Cooper Hewitt lamps show that these bring about a reduction in spoilage of 25 per cent, reduction in accidents of 30 per cent, and an increase in output averaging 10 per cent, all extremely valuable features just now.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in order to impress upon the minds of its employes the tremendous amount of food products and manufacturing material wasted each day in a large manufacturing plnt, has devised the novel scheme of fitting up a storage battery truck as a traveling exhibit, upon which is a collection of food material, including bread, butter, meat, cakes, crackers, fruit, etc., as well as a quantity of manufacturing materials, such as copper, zinc, lead, mica, rubber, felt, gum and similar materials much of which could be used to advantage. It is estimated that the food stuffs wasted each day amount to between $35 and $50, the cost of which is borne by employees. The waste of material amounts to hundreds of dollars per day and would be a loss to the company were it not that a force of men are continually assorting the seemingly scrap material and turning it back for use or so that the highest price may be obtained for scrap produce. All of this waste is largely due to the thoughtlessness and carelessness of the employees. Above the material is constructed a sign, reading in large letters: "wasted" and underneath the words "Food brought from your homes," and on the other side "Materials belonging to the company." This truck was driven up and down the shop aisles so that the employes could look upon it and form in their minds some idea of the waste. An object lesson such as this is particularly valuable at a time like the present when conservation is so strongly urged and when all precautions to effect as little waste as possible should be taken.

Men in Service

Henry G. Kobick Enters Aviation Section of Signal Corps —National Ex-Ray Reflector Company Roll of Honor

LUKE D. BOLGER, for many years connected with the San Francisco collection department of the Pacific Telephone & Telegraph Company, has answered the call to arms, joining the 320th Field Signal Battalion, and is at present located at Camp Fremont.

PACIFIC POWER & LIGHT COMPANY, Portland, Ore., in the May number of its bulletin publishes its honor roll, containing 38 names, and shows the position held with the company, military organization and present address where available.

HENRY G. KOEICK, acting superintendent of the employment bureau of the Commonwealth Edison Company, Chicago, has entered the aviation section of the Signal Corps and has left for Champaign, Ill. He volunteered a number of months ago and was accepted at that time, subject to call, and is now fulfilling his obligation. Mr. Kobick entered the services of the company in the employment bureau nine years ago as a clerk, steadily progressing to the position of head clerk. When E. A. Edkins gave up the work of superintendent of the bureau, Mr. Kobick was appointed acting superintendent. He has not only seen his department develop to a high degree of efficiency, but is largely responsible for much of that growth.

ROBERT E. SAYNER has left the maintenance department of the National X-Ray Reflector Company to join the navy, and is now at Great Lakes Naval Training Station.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, with headquarters at Chicago, now carries on its roll of honor the names of 1,702 men formerly in the employ of members of the association but now in active service with either the army or the navy.

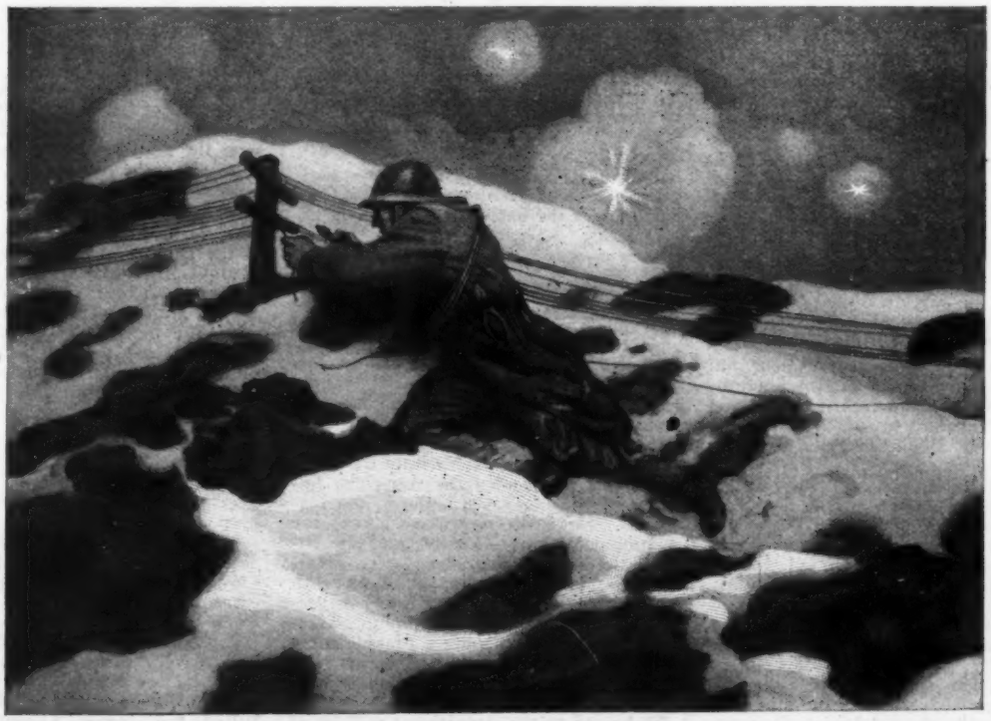
FRANK E. HUMPERT, for the past seven years manager of the Pacific Telephone & Telegraph Company at Hayward, Cal., has enlisted for active military duty. He has been succeeded by John Robinson, formerly of the sales department, San Francisco.

MAJOR DUGALD C. JACKSON, formerly of the engineering firm of D. C. Jackson & Wm. B. Jackson, Chicago, and now with the Engineer Officers Reserve, is on his way to France in compliance with a cabled request from General Pershing, asking whether he were available for immediate service there. Major William B. Jackson, also a member of the same firm and now connected with the Quartermaster's Corps, is on duty at Camp Merritt, New Jersey, as officer in charge of utilities.

G. F. EVANS, resident engineer of the National X-Ray Reflector Company in Ohio, is now serving Uncle Sam. He has been assigned to special illumination development work with the 437th Engineers.

PACIFIC TELEPHONE & TELEGRAPH COMPANY, Fresno, Cal., in the May issue of the magazine, publishes a complete list of former employes of the company who are now actively engaged in the military or naval service of the United States. The list numbers approximately 720 names and represents a large proportion of this company's employes now serving with the colors.

NATIONAL X-RAY REFLECTOR COMPANY, of Chicago and New York, now carries the following names of employes on its roll of honor: T. H. Bailey, George D. Bryson, A. J. Bruder, Darwin Curtis, William Clancy, R. S. Davies, C. G. DeSwarte, G. F. Evans, Victor Gensch, William A. Goldschmidt, Paul C. Hunter, William Laith, R. C. MacDonald, A. R. Morey, Walter Mundt, John Olinski, C. B. Pate, G. P. Prichett, John Rader, L. L. Rounds, Robert E. Sayner, Andrew Schmidt, Joe Schram, J. K. Selleck, William Slattery, N. C. Sullivan, John Wedyck, E. K. White and Frank Wozniak.



The electrical industry is not only turning over its resources and facilities to the Government to hasten the winning of the war but is giving unselfishly of its best men, who are vitally needed because of their specialized training. The American Telephone & Telegraph Company has prepared the accompanying illustration as typifying the service of telephone engineers at the front.

Personal

J. H. Van Brunt Elected President of Missouri Association —William Baum Joins Milwaukee Railway and Light

JAMES T. WHITE, formerly manager of the Oregon Gas & Electric Company at Roseburg, Ore., has been appointed manager of the Oregon Gas & Electric Company, Medford, Ore., succeeding O. R. C. Grow, resigned.

F. W. ARTHUR, who has for seven years been connected with the railway and power department of the Westinghouse Electric & Manufacturing Company at Cincinnati, Ohio, has resigned to become superintendent of sales of the Northern Ohio Traction & Light Company of Akron, Ohio.

GEORGE B. GALLAGHER, at a recent meeting of the board of directors of the Edison Electric Illuminating Company of Brooklyn, N. Y., was elected a director to fill the vacancy in the board created by the death of the late Bernard Gallagher. Mr. Gallagher has also been elected to fill a similar vacancy in the board of directors of the Kings County Electric Light & Power Company.

WILLIAM BAUM, who has been dean of the School of Engineering of Milwaukee for the last two years, has resigned his position to become research engineer for the Milwaukee Railway & Light Company, which office has been newly created. Prior to engaging in educational work, Professor Baum was connected with the General Electric Company for 14 years, during three years of which he was its foreign representative.

RALPH W. E. DONGES, president of the Board of Public Utility Commissioners of New Jersey, was recently commissioned a lieutenant-colonel in the National Army. Governor Edge of New Jersey has requested Secretary of War Baker to permit the continuance of Colonel Donges' commissionership until important rate cases now pending have been decided. He has been a member of the State Board since 1913, at which time he was appointed to the position by Woodrow Wilson, then governor of New Jersey.

J. H. VAN BRUNT, vice president and general manager of the St. Joseph Railway & Light Company, St. Joseph, Mo., was elected president of the Missouri Association of Public Utilities at its recent annual meeting. Mr. Van Brunt began his business career in the banking house of R. B. Newcombe & Company of New York City in 1885. In 1889, when Newcombe & Company and the Harriman interests were purchased by the St. Joseph Railway & Light Company, Mr. Van Brunt was sent to St. Joseph to take charge of the receipts. After a short period he was appointed superintendent of the railway department, which at that time was propelled by mule power. Mr. Van Brunt has been identified with the St. Joseph Company in different capacities since that time, and in 1902 was elected vice-president and general manager, which position he now holds.

HERBERT A. SEYMOUR, superintendent of the employment bureau of the Commonwealth Edison Company, Chicago, has been appointed to the position of acting superintendent, succeeding H. G. Kobick, resigned.

GEORGE E. HAGGAS has been appointed assistant to the general manager of the Cumberland County Power & Light Company, Portland, Me. Mr. Haggas has been connected with the company since 1915 when he was engaged to do valuable work in the engineering department.

R. M. HODGSON, formerly connected with the Philadelphia, Pa., office of the General Electric Company, has been elected vice-president and general manager and also director of the Binghamton Light, Heat & Power Company, Binghamton, N. Y., succeeding P. A. Staples, resigned. Mr. Hodgson has also been elected second vice-president and general manager of the Sayre Electric Company, Sayre, Pa.

J. C. THIRLWALL, for the past six years connected with the railway traction engineering department of the General Electric Company, Schenectady, N. Y., has resigned to accept a position with A. Merritt Taylor, in the Fleet Corporation of the United States Shipping Board. During that time his work was chiefly in the application of electric railway equipment and apparatus, and studies in economies of operation. Previous to joining the staff of the General Electric Company, he was for nine years in the mechanical department of the Brooklyn Rapid Transit Company, Brooklyn, N. Y. Mr. Thirlwall is unusually well qualified for his new position because of his operating and manufacturing experiences and his progressive ideas.

J. I. BANASH, for 11 years actively engaged as engineer at the Underwriters' Laboratories, Chicago, in the examination and testing of hazardous appliances, has been appointed engineer-in-charge of the Casualty Department. He succeeds S. V. James, who is now mechanical engineer on special research work at the Laboratories. Mr. Banash is a graduate of the Massachusetts Institute of Technology, a member of the American Society of Mechanical Engineers, the National Fire Protection Association, the National Welding Council, and the International Association of Fire Engineers. He has done much work with committees of these associations in preparing specifications for the manufacture, use and maintenance of appliances involving fire and accident hazards with the end in view of reducing these hazards. The experience which Mr. Banash brings to the department will be of special advantage in meeting the problems of devising test apparatus and standardizing test methods frequently difficult and complex.

E. E. BOON, in charge of the industrial and mining section of Westinghouse Electrical & Manufacturing Company, East Pittsburgh, Pa., visited the company's Chicago office last week.

E. L. MUNGER, for the last 23 years superintendent of the Gloucester Electric Company, Gloucester, Mass., has been promoted to the position of general manager of the company.

HAROLD E. BERG, formerly connected with the contract department of the Commonwealth Edison Company, Chicago, has joined the Booth Hall Company, manufacturer of electric furnaces, as assistant purchasing agent.

CHARLES N. GILMORE, formerly with the Enterprise Electric Construction & Sales Company of Cleveland, Ohio, has resigned to accept a position in the merchandising department of the Cutler-Hammer Manufacturing Company at Cleveland.

E. G. HOLZER, for the past 15 years manager of the Easton Gas Works, has been appointed manager of the Jenkintown division of the Philadelphia Suburban Gas & Electric Company during the absence of L. R. Dutton, who is now engaged in war welfare work with the Y. M. C. A.

G. H. BLAIKIE, formerly auditor of the Albany Southern Railroad, Albany, N. Y., has been appointed to the newly created position of auditor of the Connecticut Light & Power Company with general offices at Waterbury, Conn. His appointment to this position has largely been the result of his record with the Albany Southern Railroad.

Obituary.

W. H. CARNAHAN, assistant treasurer of the Illinois Traction System, died at Champaign, Ill., May 18, at the age of 62. He had been associated with William B. McKinley, president of that company, for 40 years in various undertakings and had been assistant treasurer of the Illinois Traction System and its component lighting and power companies for 15 years.

JAMES KEMPSTER, of New York, died at his residence in that city May 22, following a long illness. He was a very widely known electrical printer, and for over twenty years was the printer of this journal, while it was published in New York. In addition he printed nearly all the matter for the Western Union Telegraph Company, the Postal Telegraph & Cable Company and the National Electric Light Association. Mr. Kempster had a very large acquaintance among electrical men and was a popular and greatly esteemed printer, having established the James Kempster Printing Company in 1882, the year that the ELECTRICAL REVIEW was first published. He leaves one son and three granddaughters.

Financial News

Copper Prices.

The War Industries Board, during the last week in May, had under consideration the matter of again fixing the price of copper for another period beginning June 1. Copper producers have been asking for a material advance in the Government price to meet advancing costs of mining, smelting and refining. The price of 23½ cents has been in effect since last September, and it is conceded that the larger producers, at least, have been making money with copper at that price. With the smaller operators, however, whose producing costs are higher than those of the larger operators, the price has seemed hardly ample.

Within the last month copper consumption, for both war and domestic purposes, has been tremendous, with the prospect of an increase rather than a diminution in demands, and this fact makes it imperative that production shall come up to the maximum. According to all reports it is evident that producing concerns have been operating far below maximum capacities, and the advance in price seems necessary to bring about a speeding up of mines, mills, smelters and refineries. The action of the War Industries Board decided that the price of copper remain at 23½ cents a pound for 75 days, from June 1 to August 14.

Adirondack Electric Power Favors Merger Plans.

Stockholders of the Adirondack Electric Power Corporation almost unanimously favor plan for merging with five up-state New York light and power companies controlled by the General Electric Company. Approximately 95 per cent of the $9,500,000 common stock has been deposited or will deposit in favor of the plan. Outright opposition is represented by less than 300 shares. Practically the same proportion of the $2,500,000 preferred has also signified its assent. Approval of only two-thirds of the stock is required.

Holders of the present 6 per cent preferred have option of taking 7 per cent preferred or 5 per cent debentures in the new company. About one-half has expressed a preference for the 7 per cent preferred, about a third wants debentures and the remainder is undecided.

April Copper Output Shows Decrease.

From one cause and another, copper production in April of the seventeen leading companies totaled a decrease of about 8,000,000 pounds compared with March, and 9,000,000 pounds compared with the corresponding month last year. The drafting of miners is regarded as a factor of serious aspect in the effort to keep up production. Copper company officials speak of the difficulty of maintaining the necessary minimum of employes. All classes of labor used in the mines are affected. It is estimated that the domestic consumption of copper in the last three years has amounted to 3.878,872,303 pounds. This is greater than the aggregate production of the mines of this country in 1913, 1914 and 1915 and is 771,876,643 pounds larger than the world's production in 1915.

Westinghouse Earns 21.36 Per Cent on Common Stock.

The Westinghouse Electric & Manufacturing Company reports net earnings equal to 21.36 per cent on the common stock for the year ended March 31, 1918, as compared to 25.13 in the previous year. This is after all charges, including income and excess profits taxes. Although earnings such as these reflect remarkable operating achievements, the most interesting phase of the report from the standpoint of the shareholder is in what it promises for the future. The company has on its books unfilled orders amounting to $147,857,580, which compares to $39,776,739 at the close of the previous year, and that had nearly doubled the previous record. Of this enormous total of business booked, $110,185,007 calls for the regular products of the company. No facilities that have heretofore been used in the production of regular lines are now devoted to war work.

After the payment of $5,610,848 in dividends, the company increased surplus from $18,105,298 to $26,404,694. The report shows the transfer of title from the Westinghouse company to a British syndicate of the stock of the British Westinghouse Electric & Manufacturing Company, Ltd., in exchange for which the American company received 10-year debenture bonds, secured by the deposit of the stock transferred and other collateral. The former British subsidiary, now called Electric Holdings, Limited, has made a trade agreement to represent the American company in England.

Notes retired during the year leave outstanding but $52,500 of the issue of 1909. Because of the heavy inventory carried, the company increased its notes payable by $12,000,000, the total outstanding now being $30,186,051. This includes $15,000,000 one-year notes and $2,433,551 on account of Liberty Loan bonds subscribed for by employes. The loss of $5,000,000 on the Russian rifle contract the previous year was written off the books by the conversion of reserves.

Income Account.

The income account compares as follows:

	1918.	1917.
Sales billed	$ 95,735,406	$ 89,539,442
Cost of sales	80,225,936	72,077,752
Net manufacturing profit	$ 15,509,469	$ 17,461,690
Other income:		
Interest and discount	308,834	298,086
Dividends and interest	903,559	1,027,808
Miscellaneous—Royalties, etc.	112,869	60,652
Gross income	$ 16,834,733	$ 18,848,237
Deductions from income:		
Interest on bonds and debentures	303,916	89,333
Interest on notes payable	1,108,046	529,115
Miscellaneous interest	17,089	149,900
Net income	$ 15,405,680	$ 18,079,889

War Finance Board Recognizes Needs of Utilities.

The War Finance Corporation has made its first considerable loan to a public utility by making a direct advance of $3,235,000 to the United Railways Company of St. Louis. The loan will run for six months and be secured by a first mortgage and underlying bonds, together with $800,000 in Liberty loan bonds. The interest rate is 7 per cent, about 1 per cent higher than rates ruling in Chicago and on time loans in New York.

It appears the board of directors, in announcing the loan, calls attention to utility concerns in need of money that the corporation does not undertake, as a rule, to make direct loans. The bill under which the corporation was created and organized intended that relief to utilities should be primarily through the banks, the finance corporation coming to the aid of the latter by taking over the loan, holding the bank, however, responsible for its payment.

Balance Sheet.

Assets—		
Property and plant	$ 41,167,874	$ 22,701,110
Sinking fund	34,177	706
Investments	19,212,071	15,662,752
Cash	8,918,555	12,476,320
Cash on deposit	92,255	149,254
Notes and accounts receivable	29,150,835	37,693,143
Working and trading assets	60.548,532	31,934,595
Other assets	5,590,075	4,431,312
Total	$164,714,378	$127,542,811
Liabilities.		
Capital stock:		
Preferred	$ 3,998,700	$ 3,998,700
Common	70,813,950	70,813,950
Funded debt (Westinghouse Machine Company issues)	6,396,000	.....
15 year 5 per cent notes — issue of 1909—due Jan. 1, 1924	52,500	2,803,750
1 year notes—due Feb. 1, 1919	15,000.000	.....
Real estate purchase money mortgages	175,000	180,000
Notes payable—current bank loans	12,700,000	15,100,000
Subscriptions to Liberty loan bonds	2,433,551	.....
Accounts payable	8,016,098	5,988,181
Interest, taxes, etc., accrued	3,142,205	2,470,164
Accrued dividends	1,309,221	1,309,221
Advance payments on contracts	10,624,925	.....
Unpaid debenture certificates, bonds, notes and interest and dividends	92,255	149,254
Reserve	3,555,275	6,624,292
Profit and loss—Surplus	26,404,694	18,105,299
Total	$164,714,378	$127,542,811

Dividends.

Colorado Power Company has declared the regular quarterly dividend of 1¾ per cent on preferred stock, payable June 15 to stock of record May 31.

Public Service Corporation of New Jersey has declared the regular quarterly dividend of 2 per cent, payable June 29 to stock of record June 15.

Baton Rouge Electric Company has declared the regular semi-annual dividends of $3 on preferred stock and $4 on common stock, payable June 1 to stock of record May 18.

San Joaquin Light & Power Company has declared the regular quarterly dividend of $1.50 on preferred stock, payable June 15 to stock of record May 31.

Montana Power Company has declared a quarterly dividend of 1¼ per cent, payable July 1 to stock of record June 15; also a quarterly dividend of 1¾ per cent on preferred stock, payable July 1 to stock of record June 15.

American Telephone & Telegraph Company has declared the regular quarterly dividend of $2, payable July 15 to stock of record of June 20.

General Electric Company has declared the regular quarterly cash dividend of $2 per share and regular semi-annual stock dividend of 2 per cent, both payable July 15 to stock of record June 8. The cash value of fractions of shares arising out of the stock dividend, based upon the market price of the stock at the close of business June 8, will be paid to stockholders unless requests be made for payment in scrip. Dividends will not be paid upon scrip certificates issued for fractions.

Earnings.

NORTHERN STATES POWER COMPANY.

Northern States Power Company reports net earnings of $257,244 for March, as compared to $278,244 in March, 1916. For the year ended March 31 net was $3,269,453, as compared to $3,396,051 in the previous year.

NIAGARA, LOCKPORT & ONTARIO POWER COMPANY.

	1918.	1917.
April gross	$256,440	$192,221
Net after taxes	125,062	90,109
Surplus after charges	81,663	45,831
Four months gross	978,955	740,204
Net after taxes	341,498	298,392
Surplus after charges	167,882	127,090

ASHEVILLE POWER & LIGHT COMPANY.

A statement of earnings of the Asheville Power & Light Company for the year ended December 31, 1917, compared with the two previous years, follows:

	1917.	1916.	1915.
Gross earnings from operation	$497,959	$456,947	$440,285
Operating expenses, including taxes	282,244	269,775	243,758
Net earnings from operation	215,715	187,172	196,527
Other income	3,766	4,802	3,536
Total income	219,481	191,974	200,063
Interest on bonds	57,942	55,000	55,000
Other interest and deductions	1,002	401	681
Balance	160,537	136,573	144,382
Preferred stock dividends	37,539	36,520	35,000
Balance	122,998	100,053	109,382
Common stock dividends	60,000	60,000	60,000
Balance	62,998	40,053	49,382
Depreciation	35,000	35,000	35,000
Balance after depreciation	27,998	5,053	14,382

YADKIN RIVER POWER COMPANY.

A statement of earnings of the Yadkin River Power Company for the year ended December 31, 1917, compared with the two previous years, follows:

	1917.	1916.	1915.
Gross earnings from operation	$485,411	$425,477	$349,978
Operating expenses, including taxes	142,437	112,571	117,127
Net earnings from operation	342,974	312,906	232,851
Other income	15,599	1,531	1,991
Total income	358,573	314,437	234,842
Interest on bonds	175,000	175,000	175,000
Other interest and deductions	1,915	35,137	12,350
Balance	181,658	104,300	47,492
Preferred stock dividends	42,586	2,645	.....
Balance	139,072	101,655	47,492
Common stock dividends	71,443	33,100	.....
Balance	67,629	68,555	47,492
Depreciation	25,000	25,000	.....
Balance after depreciation	42,629	43,555	47,492

CAROLINA POWER & LIGHT COMPANY.

A statement of earnings of the Carolina Power & Light Company itself for the year ended December 31, 1917, compared with the two previous years, follows:

	1917.	1916.	1915.
Gross earnings from operation	$915,401	$786,916	$701,079
Operating expenses, including taxes	582,117	506,963	440,495
Net earnings from operation	333,284	279,953	260,584
Other income	138,443	102,814	60,859
Total income	471,727	382,767	321,443
Interest on bonds	161,426	150,368	131,300
Other interest and deductions	14,185	28,319	44,571
Balance	296,116	204,080	145,572
Preferred stock dividends	107,634	82,512	56,591
Balance	188,482	121,568	88,981
Common stock dividends	93,495	21,750	.....
Balance	94,987	99,818	88,981
Depreciation	60,000	60,000	50,000
Balance after depreciation	34,987	39,818	38,981

DAYTON POWER & LIGHT COMPANY.

	April, 1918.	April, 1917.	4 months ended April 30, 1918.	4 months ended April 30, 1917.	12 months ended April 30, 1918.	12 months ended April 30, 1917.
Gross earnings	$188,902	$142,023	$771,860	$636,614	$2,015,864	$1,718,613
Operating expenses (including depreciation and taxes)	130,324	95,547	558,695	433,683	1,391,556	1,157,801
Net earnings	$ 58,578	$ 46,476	$213,165	$202,931	$ 624,308	$ 560,812
Non-operating revenue	2,841	678	7,573	3,132	14,775	8,598
Total income	$ 61,419	$ 47,154	$220,738	$206,063	$ 639,083	$ 569,410
Interest on bonds	32,269	15,121	95,927	60,654	216,894	182,287
Other deductions (includes other interest and sinking fund)	11,824	10,200	47,441	41,214	130,585	85,669
Total deductions	$ 44,093	$ 25,321	$143,368	$101,868	$ 347,479	$ 267,956
Net income	$ 17,326	$ 21,833	$ 77,370	$104,195	$ 291,604	$ 301,454
Dividends on preferred stock	14,813	14,813	59,250	59,250	177,750	177,750
Surplus	$ 2,513	$ 7,020	$ 18,120	$ 44,945	$ 113,854	$ 123,704
Operating ratio	68.99%	67.27%	72.38%	68.12%	69.03%	67.37%

NEVADA-CALIFORNIA ELECTRIC CORPORATION.

	Gross earnings. 1918.	Gross earnings. 1917.	Net earnings. 1918.	Net earnings. 1917.
February	$162,813	$126,623	$ 85,580	$ 65,376
2 months	318,012	257,631	175,028	134,628

TEXAS POWER & LIGHT COMPANY.

	Gross earnings. 1918.	Gross earnings. 1917.	Net earnings. 1918.	Net earnings. 1917.
March	$ 243,887	$ 195,081	$ 77,758	$ 80,342
12 months	2,765,425	2,340,404	1,028,700	1,021,794

FORT WORTH POWER & LIGHT COMPANY.

	Gross earnings. 1918.	Gross earnings. 1917.	Net earnings. 1918.	Net earnings. 1917.
March	$ 108,458	$ 77,313	$ 46,202	$ 43,524
12 months	1,117,971	871,738	559,707	507,290

KEYSTONE TELEPHONE COMPANY.

	Gross earnings. 1918.	Gross earnings. 1917.	Net earnings. 1918.	Net earnings. 1917.
April	$134,147	$130,196	$ 58,166	$ 63,934
4 months	539,026	514,270	233,407	248,446

CITIES SERVICE COMPANY.

	Gross earnings. 1918.	Gross earnings. 1917.	Net earnings. 1918.	Net earnings. 1917.
April	$ 1,885,750	$ 1,609,013	$ 1,848,497	$ 1,578,125
12 months	20,127,717	14,361,932	19,747,715	14,083,122

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid May 21.	Bid May 28.
Adirondack Electric Power of Glens Falls, common	6	12½	12½
Adirondack Electric Power of Glens Falls, preferred	6	71	71
American Gas & Electric of New York, common	10+extra	88	88
American Gas & Electric of New York, preferred	6	40	40
American Light & Traction of New York, common	..	194	191
American Light & Traction of New York, preferred	6	95	96
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	68	68
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	..
American Telephone & Telegraph of New York	..	98½	98
American Water Works & Elec. of New York, common	..	4¾	4¾
American Water Works & Elec. of New York, particip	7	13	13
American Water Works & Elec. of New York, first preferred	..	57	57
Appalachian Power of Bluefield, common	..	3	3
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	210	211
Cities Service of New York, preferred	6	75½	74¾
Commonwealth Edison of Chicago	8	102½	102
Comm. Power, Railway & Light of Jackson, common	..	21	21
Comm. Power, Railway & Light of Jackson, preferred	6	45	46
Federal Light & Traction of New York, common	..	3	3
Federal Light & Traction of New York, preferred	..	26	26
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	15	15
Middle West Utilities of Chicago, preferred	6	..	..
Northern States Power of Chicago, common	ex.div.7	44	44
Northern States Power of Chicago, preferred	ex.div.7	85	85
Pacific Gas & Electric of San Francisco, common	..	33	33
Pacific Gas & Electric of San Francisco, preferred	6	80	80
Public Service of Northern Illinois, Chicago, common	7	74	73
Public Service of Northern Illinois, Chicago, preferred	6	82	86
Republic Railway & Light of Youngstown, common	4	22½	22
Republic Railway & Light of Youngstown, preferred	6	58	58
Standard Gas & Electric of Chicago, common	..	4½	4
Standard Gas & Electric of Chicago, preferred	6	24½	25
Tennessee Railway, Light & Power of Chattanooga, common	..	2	2
Tennessee Railway, Light & Power of Chattanooga, preferred	6	9	9
United Light & Railways of Grand Rapids, common	4	30	30
United Light & Railways of Grand Rapids, preferred	6	61½	64
Western Power of San Francisco, common	..	12	12
Western Power of San Francisco, preferred	6	49	49
Western Union Telegraph of New York	extra	92	90
Industrials—			
Electric Storage of Philadelphia, common	4	49	49
General Electric of Schenectady	8	150	146
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	44	41
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	59	58

*Last sale.